# THE MARINE REVIEW

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# Ship Building on the Lakes

*While Bulk Freighters Are Conspicuously Absent There is Nevertheless a Good Program*

THE ship yards of the great lakes have 52 vessels under construction for 1913 delivery. The list includes seven bulk freighters, three passenger steamers, two package freighters, three oil steamers, three oil barges, one car ferry, fifteen barges, three lighters, nine dredges, one floating dry dock, one lighthouse tender, one tug, one tunnel launch, one machine boat and one scow. Of this program the American Ship Building Co. is building 16, the Great Lakes Engineering Works 21, 16 of them being intended for service on the Black Warrior River in Alabama, the Toledo Ship Building Co. one, the Manitowoc Ship Building & Dry Dock Co. five, the Collingwood Ship Building Co. three, the Kingston Dry Dock Co. one, the Polson Iron Works two, and Johnston Bros. three.

Again subdividing the program, the American Ship Building Co. is building six bulk freighters, two passenger steamers, one package freighter, three oil steamers, three oil barges and one lighter. Of this program two bulk freighters, the James A. Farrell and the Percival Roberts Jr., the passenger steamer See-and-Bee, the package freighter Calgarian, and Oil Barge No. 83, have already been launched. The Great Lakes Engineering Works is building one package freighter, one passenger boat, two dredges, 15 coal barges and two lighters. Of this program the package freighter Boston has already been launched. The Toledo Ship Building Co. is building a car ferry. The Manitowoc Ship Building & Dry Dock Co. is building three dredges, one floating dry dock and one scow. The Collingwood Ship Building Co. is building one bulk freighter and two dredges. The Kingston Ship Building Co., Ltd., is building one lighthouse tender, the Polson Iron Works one tug and one tunnel launch, and Johnston Bros. one machine boat and two dredges.

It will be observed that this program is one of great variety. Lake ship builders have developed the habit of going to the coast for contracts when lake ship building is slack. Six of the vessels which the American Ship Building Co. are building are for salt water service of the Standard Oil Co. Eighteen of the vessels under contract by the Great Lakes Engineering Works are for coast service. It is probably true that from now on the leading lake ship yards will not be without orders from the coast, for it has been demonstrated that they can underbid coast yards.

The seven bulk freighters included in the 1913 program have a carrying capacity of 62,000 gross tons of ore on a single trip, or 1,240,000 tons of ore in an average season of 20 trips. During the past 11 years bulk freighters having a carrying capacity of 42,058,000 gross tons have been added to the lake fleet. The 1913 program will increase this to 43,298,000 tons, which is greater than the ore movement of any single year with the exception of 1912.

Altogether 35 vessels were launched on the great lakes during 1912, exclusive of Canadian tonnage. The list includes 11 bulk freighters (six for the coast), six package freighters (three for the coast), three oil barges for coast service, three passenger boats, one conveyor boat, one sand steamer, one oil steamer, two scows, one car ferry, two tugs, one bridge pontoon, one floating dock, one barge and one stern wheel steamer for Kootenay Lake.

Of this program the American Ship Building Co. built 16, the Great Lakes Engineering Works 10, the Toledo Ship Building Co. four, the Manitowoc Ship Building & Dry Dock Co. five, and Rieboldt, Wolter & Co. one.

Considerable remodeling of the older type of craft is now going on in order to make them more adaptable to the unloading machines. The ship yards are therefore quite busy on this class of work, removing stanchions and 'tween deck beams, compensating for the loss of strength by girders running between the hatches directly under the spar deck. The older type can no longer be handled expeditiously under the unloading machine and as dispatch is the prime asset of the business they have to be altered to meet the changed conditions.

The ship building program is not rich in bulk freighters, and it is probably wise that this condition obtains. If no additions are made for say another year, the trade will probably have well digested present capacity.

The lake trade is one which increases by leaps and bounds and no one can accurately measure it. The best that anyone can do is to attempt to foresee its development for the year ahead. Fortunately a gage exists for 1913, as tonnage has already been covered for the movement of at least 45,000,000 tons of ore. The movement will in all probability reach 50,000,000 tons. This movement, long dreamed of, is now about to be realized.

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# VESSELS UNDER CONSTRUCTION IN LAKE SHIP YARDS FOR 1913 DELIVERY

## AMERICAN SHIP BUILDING CO., CLEVELAND, O.

| To be built at | Type or name. | Dimensions in feet. Over all. | Keel. | Beam. | Depth. | Dimensions of engines. | Boilers, dimensions in ft. and in. | Draft. | Steam pressure, lbs. | Capacity, gross tons. | For whom building. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lorain..... | Bulk Frtr. Jas. A. Farrell | 600 | 580 | 58 | 32 | 24, 39, 65 x 42 | 2 Scotch 16 x 11½ | Ellis & Eaves | 170 | 12,000 | Pittsburgh Steamship Co., Cleveland, O. |
| Wyandotte.. | Pass. Str. | 500 | 485 | 58 | 23.6 | 66, 96, 96 x 108 | †See foot note | Howden | 165 | ..... | Cleveland & Buffalo Transit Co., Cleveland, O. |
| Lorain..... | Bulk Frtr. Percival Roberts Jr. | 600 | 580 | 58 | 32 | 24, 39, 65 x 42 | 2 Scotch 16 x 11½ | Ellis & Eaves | 170 | 12,000 | Pittsburgh Steamship Co., Cleveland, O. |
| Port Arthur. | Pkg. Frtr. Calgarian | 257 | 244 | 42.6 | 26.6 | 18, 29, 48 x 40 20½. | (2) 11.6 x 11 | Ellis & Eaves | 180 | 3,000 | Canadian Interlake Line. |
| Port Arthur. | Pass. Str. | 385 | 362 | 52 | 28.9 | 47½, 58, 58 x 42 | (4) 15.6 x 11 | Howden | 200 | ..... | Northern Navigation Co., Collingwood, Ont. |
| Lorain..... | Oil Str. Comet | 260 | 250 | 43 | 25 | 19, 31, 54 x 42 | 14.6 x 11.6 | Natural | 200 | 800,000 (gal.) | Standard Oil Co., N. Y. |
| Cleveland... | Oil Str. Radiant | 260 | 250 | 43 | 25 | 19, 31, 54 x 42 | 14.6 x 11.6 | Natural | 200 | 800,000 (gal.) | Standard Oil Co., N. Y. |
| Cleveland... | Oil Str. Brilliant | 260 | 250 | 43 | 25 | 19, 31, 54 x 42 | 14.6 x 11.6 | Natural | 200 | 800,000 (gal.) | Standard Oil Co., N. Y. |
| Cleveland... | Oil Bge. 83. | 260 | 250 | 43 | 23 | ..... | ..... | ..... | ... | 1,000 000 (gal.) | Standard Oil Co., N. Y. |
| Cleveland... | Oil Bge. 84. | 260 | 250 | 43 | 23 | ..... | ..... | ..... | ... | 1,000 000 (gal.) | Standard Oil Co., N. Y. |
| Lorain..... | Oil Bge. 85. | 260 | 250 | 43 | 23 | ..... | ..... | ..... | ... | 1,000 000 (gal.) | Standard Oil Co., N. Y. |
| Lorain..... | Bulk Frtr. Richard Trimble | 600 | 580 | 58 | 32 | 24, 39, 65 x 42 | 2 Scotch 16 x 11½ | Ellis & Eaves | 170 | 12,000 | Pittsburgh Steamship Co., Cleveland, O. |
| Lorain..... | Bulk Frtr. A. C. Dustin | 545 | 525 | 58 | 31 | 23½, 38, 63 x 42 | 2 Scotch 15.4½ x 11½ | Ellis & Eaves | 180 | 10,000 | John Mitchell, Cleveland. |
| Wyandotte.. | Bulk Frtr. | 257 | 244 | 43 | 21 | 18, 29, 48 x 40 | 12 x 11.6 | Howden | 130 | 3,000 | George Hall Coal Co., Ogdensburg, N. Y. |
| Wyandotte.. | Bulk Frtr. | 257 | 244 | 43 | 21 | 18, 29, 48 x 40 | 12 x 11.6 | Howden | 130 | 3,000 | George Hall Coal Co., Ogdensburg, N. Y. |
| Chicago.... | Lighter | ... | 150 | 36 | 11.6 | ..... | ..... | ..... | ... | ..... | By-Products Coke Co., Chicago, Ill. |

†Six single-ended Scotch boilers, 14 x 10.6; three double-ended Scotch boilers, 14.2⅜ x 20.5½.

## GREAT LAKES ENGINEERING WORKS, DETROIT, MICH.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecorse..... | Pkg. Frtr. Boston | 371.6 | 350 | 48 | 30 | 19, 27½, 40 x 42 | 2 Scotch 14 x 12 | Howden | 210 | 5,000 | Western Transit Co., Buffalo, N. Y. |
| Ecorse..... | Pass. Str. | 284 | 259 | 47 | 17.6 | 17½, 25, 36, 52 x 36 | 3 Scotch 12.6 x 11.6 | Positive heated | 210 | 520 psgrs. no frt. | Chicago, Duluth & Georgian Bay Transit Co., Chicago, Ill. |
| ..... | 15 coal b'ges. | 240 | ... | 32 | 8 | Gas engines | Producer gas system | None | None | 1,000 each | Alabama & New Orleans Transp. Co., New Orleans, La. |
| ..... | One fueling lighter | 240 | ... | 32 | .. | Oil engine | None | None | None | 900 | Alabama & New Orleans Transp. Co., New Orleans, La. |
| ..... | Two dredges | ... | ... | .. | .. | None | None | None | None | ..... | Joseph Supple, Portland, Ore. |
| Ashtabula... | Grain light'r. | 114 | on deck | 25 | 12.6 | None | None | None | None | 670 | Thornton & Chester Mill'g Co., Buffalo, N. Y. |

## TOLEDO SHIP BUILDING CO., TOLEDO, O.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toledo..... | Car Ferry Sainte Marie | 266 | 232 | 62 | 25 | (1) 28, 52 x 40 (1) 32, 58 x 48 | (6) 12.6 x 12 | Forced | 185 | 1,600 | Mackinac Transp. Co. |

## MANITOWOC SHIP BUILDING & DRY DOCK CO., MANITOWOC, WIS.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manitowoc.. | Dipper dge. Hull 58 | 110 | ... | 40 | 11 | ..... | one 12.6 x 12 | Natural | 150 | ..... | Fitzsimmons Connell Co., Chicago, Ill. |
| Manitowoc.. | Suction dge. Hull 59 | 185 | ... | 40 | 19 | 18, 38 x 30 | one 13 x 12.6 | Natural | 180 | 1,300 | Fitzsimmons Connell Co., Chicago, Ill. |
| Manitowoc.. | Hydraulic dge. Hull 60 | 135 | ... | 43 | 11 | 17, 27, 44 x 18 | three 12.6 x 12 | Natural | 200 | ..... | Duluth-Superior Dredging Co., Duluth. |
| Manitowoc.. | Sec. floating dry dock Hull 61 | ... | ... | .. | .. | ..... | ..... | ..... | ... | ..... | Manitowoc Ship Bldg. Co. |
| Manitowoc.. | Hull 62-3 | Two 600 yd. dump scows. | | | | ..... | ..... | ..... | ... | ..... | Fitzsimmons Connell Co., Chicago, Ill. |

## COLLINGWOOD SHIP BUILDING CO., LTD., COLLINGWOOD, ONT.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Collingwood | Bulk Frtr. No. 38 | 550 | 529 | 58 | 31 | 24, 40, 66 x 42 Triple | 3 Scotch 13 x 11 | Howden Forced | 185 | Estimate. 8,500 | St. Lawrence & Chicago Steam Navgn. Co., Ltd., Toronto. |
| Collingwood | Bucket Ladder Dredge, dpth. 52 ft. No. 39 | 218 | 210 | 37.6 | 14 | 15, 25, 42 x 26 Triple | 2 Scotch 11.6 x 10.6 | Howden Forced | 180 | ..... | Canadian Govt., Dept. Marine & Fisheries. |
| Collingwood | Bucket Ladder Dredge, dpth. 52 ft. No. 40 | 218 | 210 | 37.6 | 14 | 15, 25, 42 x 26 Triple | 2 Scotch 11.6 x 10.6 | Howden Forced | 180 | ..... | Canadian Govt., Dept. Marine & Fisheries. |

## KINGSTON SHIP BUILDING CO., LTD., KINGSTON, ONT.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kingston... | Light house No. 4 and Buoy Str. | 180.6 | 170 | 31.6 | 15.6 | (2) 12½, 21, 34 x 26 | 2 Scotch 12 x 10.6 | Natural | 180 | ..... | Canadian Govt., Dept. Marine & Fisheries. |

## POLSON IRON WORKS, LTD., TORONTO, ONT.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toronto.... | Steel tug | 80 | 72 | 20 | 10 | 12, 26 x 18 Surface cond. | (1) 10 x 11 Scotch | Natural | 150 | 160 | Dominion Government. |
| Toronto.... | Tunnel Launch | 40 | 40 | 9.3 | 3.6 | 5 x 6 Vent | Scotch 32 x 52-in. | Natural | 150 | 10 | Bishop Bregnat, Fort Resolution, Peace River. |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **JOHNSTON BROS., FERRYSBURG, MICH.** | | | | | | | | | | | |
| Ferrysburg.. | Mach. boat. | 54 | ... | 17 | 6½ | ..... | ..... | ..... | ... | 80 | New Aetna Portland Cement Co., Fenton, Mich. |
| Ferrysburg.. | Suction dge. | 114 | ... | 56 | 9½ | Elec. power | ..... | ..... | ... | 450 | Calumet & Hecla Mining Co., Calumet, Mich. |
| Ferrysburg.. | Placer dge. | 110 | ... | 40 | 9 | Elec. power | ..... | ..... | ... | 350 | Andrada Mines, Ltd., Paris, France. |
| **COWLES SHIP YARD CO., BUFFALO, N. Y.** | | | | | | | | | | | |
| Buffalo..... | Tug | 75 | 67 | 20 | 10 | 20 x 22 | 8 x 14 | Natural | 150 | ..... | Wickwire Steel Co. |
| Buffalo..... | Barge Canal Tug | 65 | 59 | 16 | 7 | 15½ x 17 | 6 x 12 | Natural | 145 | ..... | Benj. L. Cowles. |
| Buffalo..... | Supply Boat | 45 | 40 | 12 | 5 | 40 H.P. Gasoline | ..... | ..... | ... | ..... | Connelly Bros. |
| Buffalo..... | Supply Boat | 45 | 40 | 12 | 5 | 40 H.P. Gasoline | ..... | ..... | ... | ..... | John Gehm. |

# Merchant Work in Coast Yards

## *Every Shipyard on the Coast is Filled With Work — Varied and Excellent Program*

THE coast ship yards have a fine program of merchant work as well as a number of warships for foreign account. This program will doubtless be augmented as the time for opening the Panama canal approaches. The Newport News Ship Building & Dry Dock Co. has under construction the freight and passenger steamer Lenape, the freight steamer Peter H. Crowell, the oil steamer Illinois, the freight steamer Lorenzo, the freight and passenger steamer Matsonia, the freight and passenger steamer Monoa and an oil steamer and oil barge.

**New York Shipbuilding Co., Camden, N. J.**

Steel Chinese cruiser Fei Hung, 322 ft. over all, for the Chinese government; 2,600 gross tons displacement; estimated horsepower, 6.500; Parsons turbine and four express water-tube boilers.

Steel side-wheel passenger steamer Washington Irving, 414 ft. over all, for Hudson River Day Line, New York; estimated gross tonnage, 3,130; inclined engine and two double-ended and four single-ended Scotch boilers; estimated horsepower, 4,500.

Steel first-class battleship Moreno, 594 ft. 7 in. over all, for Argentine government; 27,600 gross tons displacement; Curtis turbines, eighteen Babcock & Wilcox water tube boilers; estimated horsepower, 45,300.

Steel collier Norfolk, 332 ft. 1 in. over all, for Coastwise Transportation Co., Boston; gross tonnage, 3,680; triple-expansion reciprocating engines, two single-ended Scotch boilers; estimated horsepower, 1,750.

Steel passenger and freight steamer Congress, 442 ft. 6 in. over all, for Pacific Coast Steamship Co., San Francisco, Cal.; estimated gross tonnage, 8,000; triple-expansion reciprocating engine, 10 single-ended Scotch boilers; estimated horsepower, 7,000.

Two steel car floats, duplicates, for New York Central & Hudson River Railroad Co., New York; 337 ft. over all; 1,015 gross tons.

Steel freight steamer Tyler, 344 ft. over all, for old Dominion Steamship Co., New York; estimated gross tonnage, 4,300; triple-expansion, reciprocating engine, two single-ended Scotch boilers; estimated horsepower, 1,700.

Two steel car floats, duplicates, for Delaware, Lackawanna & Western Railroad Co., Hoboken, N. J.; length over all, 270 ft.; estimated gross tonnage, 840.

Two steel bulk oil steamers Vesta and Socony, duplicates, 343 ft. 4 in. over all, for Standard Oil Co., New York; estimated gross tonnage, 3,663; triple-expansion, reciprocating engine, two single-ended Scotch boilers; estimated horsepower, 1,900.

**Maryland Steel Co., Sparrow's Point, Md.**

Six freight steamers, Montanan, Pennsylvanian, Panamanian, Ohioan, Iowan, Washingtonian, duplicates, 429 ft. 2 in. over all, for the American-Hawaiian Steamship Co., New York; estimated gross tonnage, 6,600; quadruple-expansion engine, three Scotch boilers; estimated horsepower, 3,000.

Two passenger steamers City of Richmond, and City of Annapolis, duplicates, 277 ft. over all, for Chesapeake Steamship Co., Baltimore, Md.; gross tonnage, 2,100; four-cycle triple-expansion engine, four Scotch boilers; estimated horsepower, 2,500.

**Fore River Shipbuilding Co., Quincy, Mass.**

Steel freight steamer Frieda, 314 ft. 7½ in. over all, for Union Sulphur Co., New York; estimated gross tonnage, 2,994; engine, 22½ - 39 - 63 x 48 in.; two Scotch boilers; estimated horsepower, 1,800.

Steel oil steamer Richmond, 436 ft. 4 in. over all, for Standard Oil Co., Richmond, Cal.; engine, 23 - 32¾ - 49 x 71½ in.; three Scotch boilers; estimated horsepower, 3,000.

Two car floats, duplicates, 342 ft. 3 in. over all, for the New York, New Haven & Hartford railroad.

Three steel trawlers, Wave, Billow, Breaker, duplicates, 129 ft. 6 in. over all, for the Bay State Fishing Co., Boston, Mass.; estimated gross tonnage, 255; engine, 12¾ x 22 x 36 - 24 in.; one Scotch boiler; estimated horsepower, 450.

**Bath Iron Works, Bath, Me.**

Passenger and express steamer for Maine Central railroad, Portland, Me.; 195 ft. over all; estimated gross tonnage, 600; four-cycle, triple-expansion engine; one Scotch boiler, closed stokehold, forced draft; estimated horsepower, 1,200.

Two compound triple-expansion engines, 12½ x 26¼-14 in., for destroyer building at New York Shipbuilding Co.

**Staten Island Shipbuilding Co., Port Richmond, S. I., N. Y.**

Str. F. D. Underwood, 118 ft. over all, for Baltimore & Ohio Railroad Co., New York; steam compound engine, single Scotch boiler; estimated horsepower, 1,000.

Standard Oil Co. No. 62, 208 ft. over all, for Standard Oil Co., New York; estimated gross tonnage, 850; oil engine, single screw; 300 horsepower.

Steam lighter James L. Morgan, 109 ft. over all, for General Storage Co.; estimated gross tonnage, 181; steam, compound engine, one Scotch boiler; estimated horsepower, 350.

Delivery No. 3, 98 ft. over all, for Standard Oil Co., New York; gasoline engine, 100 H. P.

New York Central No. 28, 114 ft. over all, for New York Central & Hudson River Railroad Co., New York; estimated gross tonnage, 508;

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steam compound engine, one Scotch boiler; estimated horsepower, 400.

Steamer Perth Amboy, 152 ft. over all, for Lehigh Valley Railroad Co.; estimated gross tonnage, 452; steam, triple-expansion engine, one donkey boiler; estimated horsepower, 1,000.

Standard Oil Co. No. 123, 218 ft. over all, for Standard Oil Co., New York.

Standard Oil Co. No. 124, 218 ft. over all, for Standard Oil Co., New York.

Hull 576, 140 ft. over all, for Texas Steamship Co.; triple-expansion engine, also donkey boiler; estimated horsepower, 1,000.

Hull 601, 118 ft. over all, for Hamburg-American Line; compound engine.

Hull 609, 150 ft. over all, for Hilton Dodge Lumber Co., Savannah, Ga.; triple-expansion engine and donkey boiler; estimated horsepower, 1,000.

**Harlan & Hollingsworth Corporation, Wilmington, Del.**

Steel, twin-screw, freight and passenger steamers Narragansett and Manhattan, duplicates, for Central Vermont Transportation Co.; length over all, 332 ft.; estimated gross tonnage, 4,000; two triple-expansion, four-cylinder, surface-condensing engines and six cylindrical, return tube boilers; estimated horsepower, 4,800.

One double-end screw, steel, ferryboat, 217 ft. over all, for the Central Railroad Co. of New Jersey; estimated gross tonnage, 1,565; one triple-expansion, four-cylinder, surface-condensing engine and two cylindrical return tube boilers; estimated horsepower, 1,500.

Two steel car floats, duplicates, 262 ft. 3 in. over all, for Central Railroad Co. of New Jersey; estimated gross tonnage, 852.

**Kruse & Banks, Marshfield, Ore.**

Wooden lumber carrier Davenport, for C. O. Davenport; 209 ft. long, 40 ft. beam, 17½ ft. deep; approximate tonnage, 900; engine supplied by United Engineering Works, Alameda, Cal.

Wooden lumber carrier San Ramon, for E. J. Dodge Co.; 210 ft. long, 41½ ft. beam, and 17 ft. deep; approximate tonnage, 900; engine supplied by United Engineering Works, Alameda, Cal.

**United Engineering Works, Alameda, Cal.**

Steel lumber carrier Cricket, for F. Linderman; 210 ft. long, 41 ft. beam, 17½ ft. deep; approximate tonnage, 1,200 tons; engine, 16 x 26 x 44—30; 950 H. P.

Steel tug Kanak, for the Alaska Packers' Association; 115 ft. long, 25 ft. beam and 10½ ft. deep; approximate tonnage, 220; two engines, 10½ x 24 x 14; 400 H. P.

**J. N. Rafuse, Conquerall Banks, N. S.**

Three-masted sailing vessel, 120 ft. over all; approximate value, $14,000; estimated gross tonnage, 250; estimated horsepower, 10.

**Moore & Scott Iron Works, San Francisco, Cal.**

Steel ferry steamer for Western Pacific Railway Co., San Francisco; length over all, 230 ft.; approximate value, $300,000; estimated gross tonnage, 1,150; compound engines and double-ended boilers; estimated maximum horsepower, 2,150.

**Matthews Ship Building Co., Hoquiam, Wash.**

Wooden tug Petrel, 65 ft. over all, for Polson Logging Co., Hoquiam, Wash.; approximate value, $10,000; estimated gross tonnage, 50; triple-expansion engine and Roberts boiler built by Chicago Marine Iron Works; estimated horsepower, 180.

Wooden steamer Avalon, 206 ft. oven all, for Hart-Wood Lumber Co., San Francisco, Cal.; approximate value, $125,000; estimated gross tonnage, 950; triple-expansion engine and two Babcock & Wilcox boilers, supplied by United Engineering Works, Alameda, Cal.; estimated horsepower, 650.

Wooden steamer Siskiyou, 216 ft. over all, for E. K. Wood Lumber Co., San Francisco, Cal.; approximate value, $130,000; gross tonnage, 900; engines and boilers supplied by United Engineering Works, Alameda, Cal.; 800 H. P.

Wooden steamer O. M. Clark, 209 ft. over all, for Charles H. Higgins Lumber Co., San Francisco; approximate value, $125,000; 850 gross tons; engine and boilers supplied by United Engineering Works, Alameda, Cal.; 650 H. P.

Wooden steamer for Olson & Mahony Lumber Co., San Francisco; 209 ft. over all; approximate value, $125,000; 850 gross tons; machinery supplied by United Engineering Works, Alameda, Cal.; 650 H. P.

**Hartford & New York Transportation Co., Hartford, Conn.**

Barge H. & N. Y. T. Co. No. 32, wood, for Hartford & New York Transportation Co., Hartford, Conn.; length over all, 157 ft. 5 in.; approximate value, $17,000; estimated gross tonnage, 551.

**Johnson Iron Works, Ltd., Julia and Water Streets, New Orleans, La.**

Steel barge, 100 ft. over all, for local parties; approximate value, $10,500.

Two steel barges, duplicates, 100 ft. over all, for Galveston parties; approximate value, $9,000 each.

Two motor boats, duplicates, 45 ft. over all, for export to Central America; approximate value, $3,500 each; gasoline engines; estimated horsepower, 36.

Motor boat, 45 ft. over all, for export to Central America; approximate value, $2.700; oil engine; estimated horsepower, 45.

**Gildersleeve Shipbuilding Co., Gildersleeve, Conn.**

Two bay barges, duplicates, 175 ft. over all, for Dempsey & Sons, Philadelphia, Pa.; approximate value, $16,000 each; estimated gross tonnage, 426.

Four deck scows, duplicates, 110 ft. over all, for Oliver Gildersleeve & Sons, Inc.; approximate value, $8,000 each; estimated gross tonnage, 310.

**M. A. Sweeney Ship Yard & Foundry Co., Jeffersonville, Ind.**

Sternwheel, steel, survey boat John Ewens, for U. S. Engineer Corps, Mississippi River Commission; length over all, 140 ft.; approximate value, $27,400; estimated gross tonnage, 180; balance valve, western river type engines, 11 in. diameter 6 ft. stroke; estimated horsepower, 70.

**G. G. Deering Co., Bath, Me.**

Wooden, five-masted schooner for G. G. Deering Co., Bath, Me.; length over all, 275 ft.; approximate value, $85,000; estimated gross tonnage, 1,900.

**Hall Bros. Marine Railway & Shipbuilding Co., Winslow, Wash.**

Gas tug Kumtux, 65 ft. over all, for Puget Sound Towage Co., Seattle, Wash.; approximate value, $11,000; estimated gross tonnage, 110; Corliss gas engine; estimated horsepower, 125.

Steam tug Arctic, 125 ft. over all, for the Pioneer Sand & Gravel Co., Seattle, Wash.; approximate cost, $38,000; estimated gross tonnage, 450; fore and aft compound engine, built by Neafie & Levy, Wilmington, Del.; Scotch boiler, built by Commercial Boiler Works, Seattle, Wash.; estimated horsepower, 500.

**Bridgeport Shipyard Department of the Lake Torpedo Boat Co., Bridgeport, Conn.**

Oyster dredger, 92 ft. over all, for Smith Bros., New Haven, Conn.; approximate value, $25,000; estimated gross tonnage, 125; vertical compound engine, upright tubular boiler; estimated horsepower, 150.

**Southern Pacific Co., West Oakland Yards, West Oakland, Cal.**

Steel sidewheel passenger ferry steamer Alameda, 292 ft. 4 in. over all, for Southern Pacific Co., San Francisco, Cal.; approximate value, $450,000; estimated gross tonnage, 2,-

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700; four horizontal tandem compound engines; four Babcock & Wilcox water tube boilers; estimated horsepower, 2,500.

Wooden sidewheel passenger and freight car transfer steamer Contra Costa, 433 ft. 4 in. over all, for Southern Pacific Co., San Francisco, Cal.; approximate value, $400,000; estimated gross tonnage, 3,600; four horizontal simple engines, eight Scotch dryback boilers; estimated horsepower, 3,000.

**Gas Engine & Power Co. and Chas. L. Seabury & Co., Cons., Morris Heights, New York.**

Steel steam yacht Vixen, 167 ft. over all, for J. D. Archbold, New York; gross tonnage, 270; estimated horsepower, 1,400; triple - expansion, twin-screw engine.

Steel steam yacht for Henry Rutherford, New York, 140 ft. over all, 170 gross tons; estimated horsepower, 700; two Seabury safety water tube boilers.

Steel motor yacht, 126 ft. over all, for Clarke Poole, Chicago; gross tonnage, 170; estimated horsepower, 300; two Speedway gasoline engines.

Twenty launches, 20 to 65 ft. over all, equipped with Speedway gasoline engines for various parties.

**Seaford Marine Railway Co., Seaford, Del.**

Wooden, two-masted barge John B. Whealton, for John B. Whealton and George F. Phillips, of Norfolk, Va.; 195 ft. over all, 35 ft. beam; approximate value, $30,500; 1,400 tons deadweight capacity; donkey boiler for hoisting.

## Machinery Under Construction

**Main St. Iron Works, San Francisco, Cal.**

Supplying compound engines and Scotch boilers for steamer Speedwell, building at Kruse & Banks' yard, Marshfield, Ore., for the Southern Oregon Transportation Co.

Also supplying engines and boilers for steamers Multnomah and Merced, building by the St. Helens Shipbuilding Co., St. Helens, Ore., for Charles R. McCormick & Co.

**Union Gas Engine Co., San Francisco, Cal.**

Supplying Union gas engine of 500 H. P. for car ferry building for the Oakland & Antioch railroad by Schultze-Robertson-Schultze, San Francisco.

Gas engine of 150 H. P. for a fishing schooner building for the Union Fish Co. at the Union Gas Engine Co.'s yards.

One 250 H. P. for a cattle transport building for Vale & Vickers by William Muller, San Pedro.

Two of 100 H. P. each for fishing schooners building for the New England Fish Co.

One of 100 H. P. for a sternwheel freighter building for Hood & Co. by the Peterborough Canoe Co., Peterborough, Can.

One of 100 H. P. for a towboat for the Crowley Launch & Tugboat Co.

**The Portland Co., Portland, Me.**

Supply machinery for the towboat East Hampton building for Sickler & Meadows, New York City, by the Cobb-Butler Co., Rockland, Me.

Also machinery for a fishing steamer building for the Macomber & Nickerson Co., Providence, R. I., by Robert Palmer & Son, Noank, Conn.

Also complete marine outfit for Alaska-Portland Packers' Association of Portland, Ore., consisting of a marine engine 12½-30 x 20.

**Almy Water Tube Boiler Co., Providence, R. I.**

Two boilers for U. S. Torpedo experimental float building at the Staten Island Shipbuilding Co..

One boiler for steamer Squantum, Providence, R. I.

Two boilers for steam yacht Legonia undergoing repairs at the Marine Railway, Machine & Boiler Works, Baltimore, Md.

Boiler for steamer Defiance, Poulsbo, Wash.

**Babcock & Wilcox Co., 85 Liberty St., New York.**

The Babcock & Wilcox Co. are building boilers for the following vessels, which are either under construction or repair: Revenue cutter Calumet, U. S. revenue service; battleship Oklahoma, U. S. navy; steamer San Ramon, E. J. Dodge Co.; steamer Matsonia, Matson Navigation Co.; tug Manhattan, City of New York; dredge George W. Allen, Florida East Coast Co.; ferryboat, Western Pacific railway; steamer O. M. Clark, Charles H. Higgins; gunboat, Sacramento, U. S. navy; revenue cutter Manning, U. S. revenue cutter service; yacht, building at Pusey & Jones Co., Wilmington, Del.; yacht, building for D. C. Jackling; gunboat Monocacy, U. S. navy; gunboat Palos, U. S. navy.

**United Engineering Works, Alameda, Cal.**

One engine, 13½ x 23 x 40-30, for wooden lumber steamer Davenport, building by Kruse & Banks, Marshfield, Ore.; 825 H. P.

One engine, 13½ x 22 x 36-24, for wooden lumber carrier Avalon, building by Matthews Ship Building Co., Hoquiam, Wash.; 675 H. P.

One engine, 13½, 23, 40 x 30, for wooden lumber carrier Siskiyou, building by Matthews Ship Building Co.; 825 H. P.

One engine, 14 x 32 x 24, for wooden lumber steamer Necanicum, building by Hammond Lumber Co.; 425 H. P.

One engine, 13½ x 23 x 40-30, for wooden lumber carrier San Ramon, building by Kruse & Banks, Marshfield, Ore.; 825 H. P.

One engine, 13½ x 22 x 36-24, for wooden lumber steamer O. M. Clark. building by Matthews Ship Building Co.; 675 H. P.

One engine, 13½, 22, 36 x 24, for wooden lumber carrier, building by Matthews Ship Building Co. for Olson & Mahony; 675 H. P.

**Harlan & Hollingsworth Corporation, Wilmington, Del.**

Four cylindrical return tube boilers for four hulls building by E. J. Tull, Pocomoke City, Md., for the Ellicott Machine Corporation, Baltimore, Md.; 1,280 H. P.

One compound, surface-condensing engine and one cylindrical return tube boiler for wooden hull, building by W. G. Abbott, Milford, Del., for the Delaware Fish Oil Co., Lewes, Del.; estimated horsepower, 400.

One compound, surface-condensing engine and one cylindrical return tube boiler for wooden hull, building by W. G. Abbott, Milford, Del., for Lewes Fisheries Co., Lewes, Del.; estimated horsepower, 480.

One cylindrical return tube boiler for tug Kanak, building by United Engineering Works, San Francisco, Cal.; estimated horsepower, 320.

One locomotive type boiler for ferryboat Ocean City, building for Delaware River Ferry Co., of Camden, N. J.; estimated horsepower, 700.

One cylindrical return tube boiler for tug Murrell, building for New England Coal & Coke Co., Boston, Mass.; estimated horsepower, 554.

One cylindrical return tube boiler for floating grain elevator Empire, building for Philadelphia Harbor Transfer, Philadelphia; estimated horsepower, 314.

One cylindrical return tube boiler for fishing steamer Breakwater, building for Lewes Fisheries Co., Lewes, Del.; estimated horsepower, 264.

One compound, surface-condensing engine and one cylindrical, return tube boiler for wooden hull being built under order of Harlan & Hollingsworth Corporation by American Car & Foundry Co., Wilmington, Del., for Virginia Fisheries, Inc.; estimated horsepower, 480.

Two triple (one pair) surface-condensing engines for twin screw yacht hull, building by the Pusey & Jones Co., Wilmington, Del.; estimated horsepower, 1,200.

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# Lake Launchings During 1912

***The Ship Yards of the Lakes Put Quite a Variety of Craft in the Water During 1912***

DURING 1912, exclusive of Canadian yards, the lake ship yards launched 35 vessels, of which eleven were bulk freighters (six for the coast), six package freighters (three for the coast) three oil barges for coast service, three passenger boats, one conveyor boat, one sand steamer, one oil steamer, two scows, one car ferry, two tugs, one bridge pontoon, one floating dock, one barge and one stern wheel steamer for Kootenay lake.

The five lake bulk freighters have a carrying capacity of 48,000 tons on a single trip or 960,000 tons in an average season of 20 trips.

During 1911, exclusive of Canadian yards, lake ship yards launched 42 vessels, of which nine were bulk freighters (four for coast service), two package freighters for coast service, two passenger steamers, two oil steamers, five oil barges, eight tugs, one fuel lighter, one sand steamer, one car ferry, three tow boats, four scows, two light vessels, one river lighter and one car float.

The five lake bulk freighters have a carrying capacity of 55,000 gross tons of ore in a single trip or 1,100,000 tons in an average season of 20 trips.

During 1910, exclusive of Canadian yards, lake ship yards launched 51 vessels, of which 20 were bulk freighters, three package freighters, two passenger steamers, three car ferries, one river ferry, one lumber steamer, 12 tugs, three lighters, one lighthouse tender, one sand sucker, two dump scows and two gold dredges. Of this program the American Ship Building Co. launched 24, of which 10 were bulk freighters, one passenger boat, six tugs, three package freighters, two car ferries, one river ferry and one lighter. The Great Lakes Engineering Works launched nine bulk freighters; the Toledo Ship Building Co. one lumber steamer; the Manitowoc Dry Dock Co. two lighters, one sand sucker and two dump scows; the Racine Boat Mfg. Co., one lighthouse tender; Johnston Bros., five fish tugs and two gold dredges; and Robert Curr, at Cleveland, built and launched a tug from Murphy & Donnelly's boiler shop.

The 20 bulk freighters have a carrying capacity of 194,500 gross tons in a single trip, or 3,890,000 gross tons in an average season of 20 trips.

During 1909, the lake ship yards, exclusive of Canadian yards, launched 39 vessels, of which 17 were bulk freighters, five were package freighters, five passenger steamers, six tugs, five lighters and one survey boat.

During 1908, exclusive of Canadian yards, lake ship yards launched 39 vessels, of which 24 were bulk freighters, two passenger boats, one package freighter, three tugs three fire boats, one lightship, two drill boats, one sand sucker and one supply boat.

These 24 bulk freighters have a carrying capacity of 101,400 tons on a single trip, or 2,028,000 tons in an average season.

During 1907 the lake ship yards, exclusive of Canadian yards, launched 56 vessels, of which 40 were bulk freighters, three package freighters, one passenger steamer, one wrecker, one lighter, one mail boat, five tugs and four scows. These 40 bulk freighters have a carrying capacity of 368,000 gross tons on a single trip. However, as one of the new steamers, the Cyprus, sank on her second trip, the net addition of that year was 361,000, or 7,220,000 tons in an average season.

During 1906, the ship builders of the great lakes, exclusive of the Canadian yards, launched 47 vessels, of which 40 were bulk freighters, two passenger steamers, two package freighters, two car ferries and one sand dredge. The 40 bulk freighters have a carrying capacity of 381,000 tons on a single trip, or 7,620,000 gross tons in an average season of 20 trips.

During 1905, the ship builders of the great lakes, launched 32 steamers, of which 29 were bulk freighters, two package freighters and one car ferry. These 29 bulk freighters have 260,200 gross tons carrying capacity on a single trip, or 5,204,000 gross tons in an average season of 20 trips.

During 1904 lake shipyards launched 13 vessels, of which seven were bulk freighters, two package freighters, one car ferry and three passenger steamers. The seven bulk freighters have a carrying capacity of 51,300 tons on a single trip, or 1,026,000 in an average season of 20 trips.

During 1903, lake shipyards launched 50 vessels, of which 42 were bulk freighters, five car ferries and three passenger steamers. These 42 bulk freighters have a carrying capacity of 213,250 tons on a single trip or 4,265,000 tons in an average season of 20 trips. It should be stated, however, that 10 of the freighters were built by Mr. Wolvin for St. Lawrence river trade and are actively engaged in that service, but as they are available for the ore trade, they have been classed as bulk freighters with an average capacity of 3,000 tons each on 18-ft. draught.

During 1902, the lake ship yards launched 41 vessels, of which 32 were bulk freighters (two of them barges), two passenger steamers, three package freighters, two car ferries and two vessels for salt water service. These 32 bulk freighters have a carrying capacity of 171,910 tons on a single trip, or 3,438,200 tons in an average season of 20 trips. The particulars of vessels launched during 1912 will be found in the table published on the opposite page.

## Steamer Washington Irving Launched

The sidewheel steamer Washington Irving, building for the Hudson River Day Line, was launched from the yard of the New York Ship Building Co., Camden, N. J., on Dec. 7, being christened by Mrs. Eben Erskine Olcott, wife of the president of the company. The launching party was a distinguished one, including Sir Thomas Lipton and representatives of the family of Washington Irving.

The dimensions of the new steamer are: Length over all, 416 ft., 6 in.; beam molded, 47 ft.; beam over guard, 86 ft., 6 in.; depth, 14 ft., 6 in. The engine is of the three-cylinder, compound, inclined type, steam being supplied by four single and two double-ended Scotch boilers. As she is intended for day service exclusively there are no sleeping quarters. She is licensed to carry 6,000 passengers.

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The St. Lawrence Marine Railway Co., Ogdensburg, N. Y., are now equipping a modern machine shop and expect to have it in operation early in January. They will be prepared to do all classes of machinery repairs.

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## LAKE LAUNCHINGS DURING 1912.

### AMERICAN SHIP BUILDING CO.'S YARDS.

| Where built. | Type. | Name of Vessel. | Length over-all, ft. | Carrying capacity, gross tons. | Name and Address of Owners. |
|---|---|---|---|---|---|
| Cleveland | Pass. Str. | City of Grand Rapids. | 310 | ..... | Graham & Morton Transportation Co., Chicago, Ill. |
| Wyandotte | Conveyor Str. | Calcite | 440 | 5,000 | Calcite Transportation Co., Detroit, Mich. |
| Cleveland | Sand Str. | Frank C. Osborn | 166 | 750 yds. | Pelee Island Sand & Gravel Co., Cleveland, O. |
| Lorain | Oil Str. | Renown | 394 | 1,500,000 (gal.) | Standard Oil Co., New York. |
| Port Arthur | Pkg. Frtr. | Hamiltonian | 257 | 3,000 | J. W. Norcross & Co., Toronto, Ont. |
| Wyandotte | Bulk Frtr. | Lucius W. Robinson | 257 | 3,000 | George Hall Coal Co., Ogdensburg, N. Y. |
| Lorain | Bulk Frtr. | James A. Farrell | 600 | 12,000 | Pittsburgh Steamship Co., Cleveland, O. |
| Lorain | Oil Bge. | No. 89 | 260 | 1,000,000 (gal.) | Standard Oil Co., New York. |
| Lorain | Oil Bge. | No. 90 | 260 | 1,000,000 (gal.) | Standard Oil Co., New York. |
| Wyandotte | Pass. Str. | See-and-Bee | 500 | ..... | Cleveland & Buffalo Transit Co., Cleveland, O. |
| Cleveland | Oil Bge. | No. 83 | 260 | 1,000,000 (gal.) | Standard Oil Co., New York. |
| Lorain | Bulk Frtr. | Percival Roberts Jr. | 600 | 12,000 | Pittsburgh Steamship Co., Cleveland, O. |
| Cleveland | Dump Scow | No. 22 | 180 | ..... | C. H. Starke Dredge & Dock Co., Milwaukee, Wis. |
| Port Arthur | Sternwheel Str. | ..... | 227.6 | ..... | Canadian Pacific Railway, Fort William, Ont. |
| Port Arthur | Pkg. Frtr. | Calgarian | 257 | 3,000 | Canadian Interlake Line, Ltd., Toronto, Ont. |

### GREAT LAKES ENGINEERING WORKS, DETROIT, MICH.

| | | | | | |
|---|---|---|---|---|---|
| Ecorse | Bulk Frtr. | Wm. P Snyder Jr. | 617 | 14,000 | Shenango Steamship & Transportation Co., Perry-Payne Bldg., Cleveland, O. |
| Ecorse | Pkg. Frtr. | Yaguez | 261 | 3,000 | Ocean Freight Line, Inc., New York. |
| Ecorse | Pkg. Frtr. | Bayomon | 261 | 3,000 | Ocean Freight Line, Inc., New York. |
| Ashtabula | Bulk Frtr. | Louis R. Davidson | 524 | 8,500 | Boland & Cornelius, Buffalo, N. Y. |
| Ecorse | Bulk Frtr. | Robert M. Thompson | 240 | 1,000 | American Transportation Co., New York. |
| Ecorse | Bulk Frtr. | A. A. Raven | 261 | 3,000 | American Transportation Co., New York. |
| Ecorse | Pkg. Frtr. | Ruby | 261 | 3,000 | American Transportation Co., New York. |
| Ecorse | Bulk Frtr. | Edison Light | 261 | 3,000 | Boston & Virginia Trans. Co., Boston, Mass. |
| Ecorse | Bulk Frtr. | George Hawley | 261 | 3,000 | Boston & Virginia Trans. Co., Boston, Mass. |
| Ecorse | Pkg. Frtr. | Boston | 390 | 5,000 | Western Transit Line, Buffalo. |

### TOLEDO SHIP BUILDING CO., TOLEDO, O.

| | | | | | |
|---|---|---|---|---|---|
| Toledo | Pass. Str. | Thousand Islander | 172.6 | ..... | Thousand Island Steamboat Co., Cape Vincent, N. Y. |
| Toledo | Bulk Frtr. | Geo. E. Warren | 261 | ..... | Boston & Virginia Trans. Co., Boston, Mass. |
| Toledo | Bulk Frtr. | L. V. Stoddard | 261 | ..... | Boston & Virginia Trans. Co., Boston, Mass. |
| Toledo | Car Ferry | Sainte Marie | 266 | ..... | Mackinac Transportation Co., St. Ignace, Mich. |

### MANITOWOC SHIP BUILDING & DRY DOCK CO., MANITOWOC, WIS.

| | | | | | |
|---|---|---|---|---|---|
| Manitowoc | Tug | Richard Fitzgerald | 92 | 167 | Chicago Lighterage Co., Chicago, Ill. |
| Manitowoc | Dump Scow | ..... | ... | 600 yds. | Fitzsimmons & Connell Co., Chicago, Ill. |
| Manitowoc | Tug | Conrad Starke | 92 | 140 | Milwaukee Tug Boat Line, Milwaukee, Wis. |
| Manitowoc | Bridge Pontoon | ..... | ... | ..... | City of Chicago, Ill. |
| Manitowoc | Floating Dry Dock | ..... | 360 | 4,500 | Manitowoc Ship Building & Dry Dock Co., Manitowoc, Wis. |

### COLLINGWOOD SHIP BUILDING CO., LTD., COLLINGWOOD, ONT.

| | | | | | |
|---|---|---|---|---|---|
| Collingwood | Dredge Scow | ..... | 80 | ..... | C. S. Boone Dredging & Construction Co., Ltd., Toronto, Ont. |
| Collingwood | Lighthouse Str. | Estevan | 212 | ..... | Canadian Government. |
| Collingwood | Canal Str. | Keybell | 258.8 | 2,250 | Keystone Transportation Co., Ltd., Montreal, Can. |

### POLSON IRON WORKS, TORONTO, ONT.

| | | | | | |
|---|---|---|---|---|---|
| Toronto | Tug | G. R. Geary | 70 | ..... | City of Toronto. |
| Toronto | Sidewheeler | No. 102 | 40 | ..... | Catholic Mission. |
| Toronto | Sidewheeler | No. 103 | 40 | ..... | Catholic Mission. |
| Toronto | Screw Launch | No. 104 | 40 | ..... | Anglican Mission. |
| Toronto | Yacht Club Tender | Kwaisind | 70 | ..... | Royal Canadian Yacht Club. |
| Toronto | Drill Boat | Faugh-a-Ballagh | 80 | ..... | J. E. Russell, Toronto. |
| Toronto | Tug | No. 106 | 80 | ..... | Dominion Government. |
| Toronto | Tug | Batchawana | 55 | ..... | Dominion Government. |
| Toronto | Launch | No. 109 | 40 | ..... | Catholic Mission. |

### RIEBOLDT, WOLTER & CO., STURGEON BAY, WIS.

| | | | | | |
|---|---|---|---|---|---|
| Sturgeon Bay | Barge | Pequeming | 145 | 1,000,000 (ft. lbr.) | Charles Hebard & Sons, Pequaming, Mich. |

### KINGSTON SHIP BUILDING CO., LTD., KINGSTON, ONT.

| | | | | | |
|---|---|---|---|---|---|
| Kingston | Steamer | Bellechasse | 142 | ..... | Department of Marine & Fisheries, Ottawa, Ont. |
| Kingston | Steamer | Dollard | 180 | ..... | Department of Marine & Fisheries, Ottawa, Ont. |

## Steamer Speedwell

The steamer Speedwell, which the Main Street Iron Works, 163-173 Main street, San Francisco, Cal., is building for the Southern Oregon Transportation Co., will have an over-all length of 200 ft.; keel, 193 ft.; beam, 42 ft., and depth of hold, 11 ft., 10 in. She will be equipped with twin-screws driven by two compound engines, 14 and 32 in. cylinder diameters by 20-in. stroke, developing 450 H. P. each at 135 revolutions. Steam will be furnished by two Scotch boilers, 9 ft. diameter and 12 ft. long, fitted with a steam drum on each boiler 36 in. inside diameter and 7 ft. long. The vessel will be fitted with independent feed, bilge, air and sanitary pumps, independent condenser and electric light generating sets. The steamer will have accommodations for about 60 passengers and 800,000 ft. of lumber.

The Main Street Iron Works is also building the steamer Multnomah and Merced for Charles R. McCormick & Co. These steamers are 211 ft. over all, 204 ft. keel, 40 ft., 6 in. beam and 15 ft., 6 in. deep. Their mechanical equipment consists of a triple-expansion engine, 13½, 23 and 40-in. cylinder diameters by 30-in. stroke, supplied with steam from two Babcock & Wilcox boilers, having a total heating surface of 2,800 sq. ft., using crude oil as fuel. The steamers will carry about 60 passengers and 1,250,000 ft. of lumber.

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# Active Type of Stabilizing Gyro

## *Mr. Sperry's Device to Prevent Rolling of Ships as Well as to Roll Them Artificially as Presented to the Naval Architects' Society*

By Elmer A Sperry

THE subject with which this paper deals is one that has received attention and has for some time been under investigation by the architects of our navy. Two years ago I was permitted to touch upon some small portion of this work; since that time the progress has been marked. In fact, with the data now available, it is possible to design a stabilizing plant which will confine the roll of a ship to almost any limit desired, regardless of the displacement and period of that ship. The same type of plant may be used for rolling the ship at will, which feature has an important application in our icebound waters.

It is felt that when the data relating to the active type of gyros is ready to be given to the world, the important subject of stabilizing ships will receive by far its most interesting chapter and not unlikely its most important contribution.

The advantages to be derived by efficiently stabilizing ships may be summarized as follows:

(a) Saving in power and consequent saving in fuel owing to the ability to maintain the shortest course between two points in bad weather, inasmuch as the ship will be in no danger from excessive rolling when steaming even in the trough of the sea.

(b) Saving in power and consequent saving in fuel owing to the fact that the wetted surface is not increased by wallowing, inasmuch as the vessel is always held on an even keel.

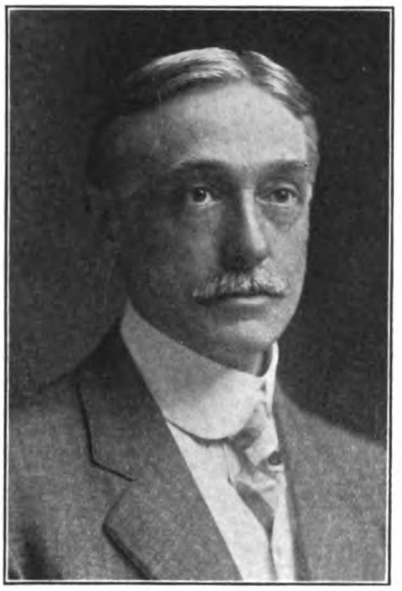
(c) Saving in power and consequent saving in fuel by elimination of rolling against the relatively stiff water when under way. The increase in the power required to drive a vessel which is rolling is due to what is known as the keel or form line impingent. It is illustrated by the longer period of the roll of the vessel when steaming as compared to the period when not under way.

(d) Saving in power and consequent saving in fuel by reducing the yawing and tendency to follow a sinuous course.

(c) Saving in fuel and weight by the elimination of bilge keels.

(f) Making small ships as comfortable for passengers as large ships, while at the same time being able to prevent the largest from rolling.

(g) Eliminating stresses in the structure of the ship and the stresses in the accessories and auxiliaries contained within the ship, which are caused by excessive rolling.



**ELMER A. SPERRY.**

Elmer A. Sperry was born at Cortland, New York, Oct. 12, 1860. He studied at Cornell, under Profs. Anthony, Sweet and Moler. In 1880 he started with his own company in Chicago, the Sperry Electric Co., manufacturing arc light dynamos, lamps and motors. He was later engineer in the Standard Electric Co., the Sperry Electric Mining Machinery Co., the Link Belt Machinery Co., the Sperry Engineering Co., and the Sperry Electric Railway Co., of Cleveland, O. The Sperry Electric Mining Machinery Co. was the pioneer concern in this line of work.

He later perfected a system of electric traction, in which field he did much pioneer work. He was also a charter member of the American Institute of Electrical Engineers, the National Electric Light Association and the American Electro-Chemical Society.

(h) Preventing deterioration in cargo caused by excessive rolling. This would particularly apply to ships carrying live stock as cargo.

(i) Ability to roll the ship artificially for the purpose of freeing from or rolling off sand or mud banks by opening the contacting crevices and gradually liquefying the encumbent mass.

(j) Making a ship more seaworthy by preventing the shipping of seas due to rolling.

(a) Decreasing the amount of under-water armor, which it is necessary to place on men-of-war at present in order to protect that portion of the hull which might be exposed to the enemy by rolling.

(b) Steady gun platform.

(c) Ability to go into action in any state of sea or upon any course in rough weather.

(d) Improving the condition of men and officers by eliminating the fatiguing and other effects of incessant and constant rolling.

(e) Ability to roll the ship artificially to standard angles, if so desired, in competitive target practice.

There is no doubt about the very great desirability of steady ships. We believe that shipping interests and the marine generally are indebted to the recent German workers for again bringing this important subject into prominence. Both Dr. Schlick and Herr Frahm have been working in the same line in one particular, namely, damping roll of ships after motion of some magnitude has set in. In point of fact, they diminish the amount of such roll by setting up counter forces having their origin in the motions themselves and depending upon such motions for their existence.

Turning again to the operation of damping tanks in the original paper by Mr. Frahm, much stress is laid upon the point that the fundamental principle of this operation, using his own words, "consists in setting up a secondary and artificial resonance in order to annihilate the primary resonance between waves and ship, it being on this fact that their operation is based."

The very grave question arises:—Is the basic proposition here enunciated true? Is there any primary resonance between waves and ship or really any approach to such a condition? This question was raised in this discussion by one of the nestors of this art, and a fact was pointed out by him which has been the basis of minute analysis on this side of the Atlantic for some years past, namely, the oft-recurring cycles, or groups, universally present in rolling records. The facts thus brought out by Sir John I. Thornycroft agree in the main with the results reached early in this investigation by similar analysis on this side. These cycles are to be seen in any rolling record, for instance, in Figs. 1, 2 and 3, where it will be seen that the rolling gradually increases to a maximum and then decreases to a minimum, whereupon another increase takes place, to be followed by another decrease and so on. The sea is doing work upon the ship for a time and then, in the words of Thornycroft, "it again un-

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does its work." In a very choppy sea the recurrence of these cycles is very much accentuated; the groups become smaller and less regular and sometimes more difficult to trace, but still they are there. This can point to but one conclusion, namely, the absence of anything that approaches true resonance between waves and ship. It also argues strongly against any stabilizing device which is limited to resonance phenomena only, be it primary or secondary resonance. Let us examine these curves more minutely. It will be observed that at the end of each cycle, before the next one starts, there is usually a change, more or less definite, in the phase of the period where there is an apparent "fault" in the regularity of the curves. The curves in Fig. 1 are taken from a very favorable sea, and when we examine curves 1, 2 and 3, which are taken from a less favorable sea, we see that these faults are more numerous and occur with greater frequency. With this feature, which is characteristic of all rolling of ships, how can it be successfully attacked by a device the underlying principle of which depends upon periodicity and synchonism? The water in the damping tanks can only create its damping movements as a result of regular oscillations, and if this oscillation is irregular the reactions fail to be propagated, and when the period changes what force is there present to readjust the operation to the new condition? Of course the answer to all of these questions is that tanks do not dampen under these conditions.

*Easy Rolling Conditions*

It is true that there are easy rolling conditions in an old sea where they show to the greatest advantage and the damping action amounts to quite a comfortable percentage of the undamped rolling. But what are we to say of other sea conditions which are much more aggravated; and which, owing to their being more usual, are more important? It has been shown in this art that if the tanks are placed high and are supplied with water representing a sufficiently great percentage of the displacement of the ship the damping is good when the sea is synchronous, or approaches synchronism. But who is to guarantee the continuance of the synchronous condition? Certainly it does not exist on the high seas as we have found them.

Let us examine more minutely as to what happens when the sea is not sychronous. Let us consider the instances only slightly removed from synchronism. We find that the tanks have already practically failed to perform any useful function whatever

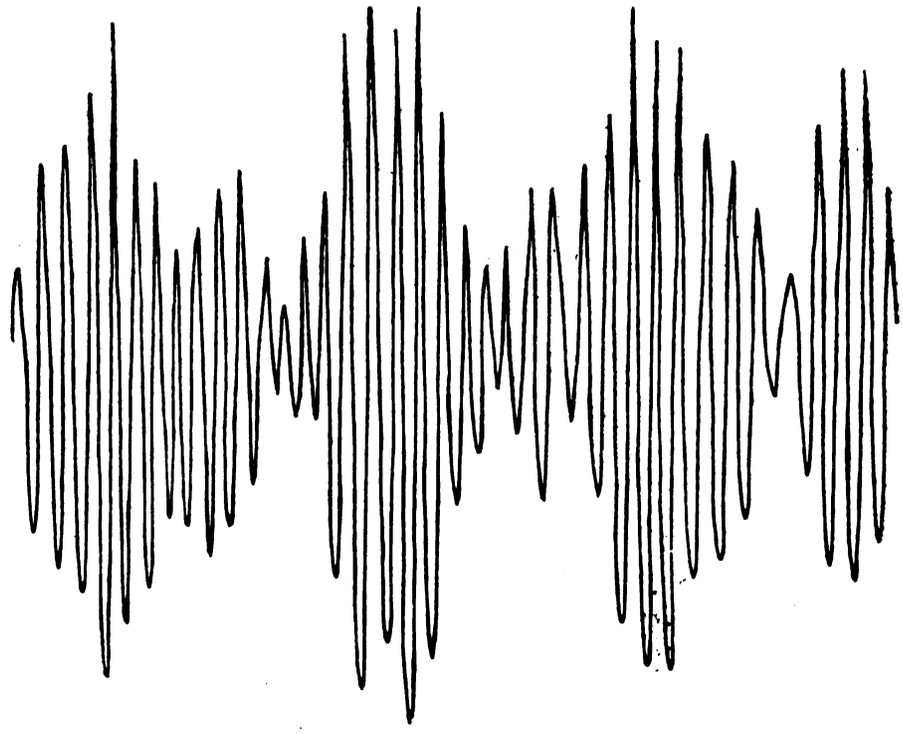

FIGURE 1

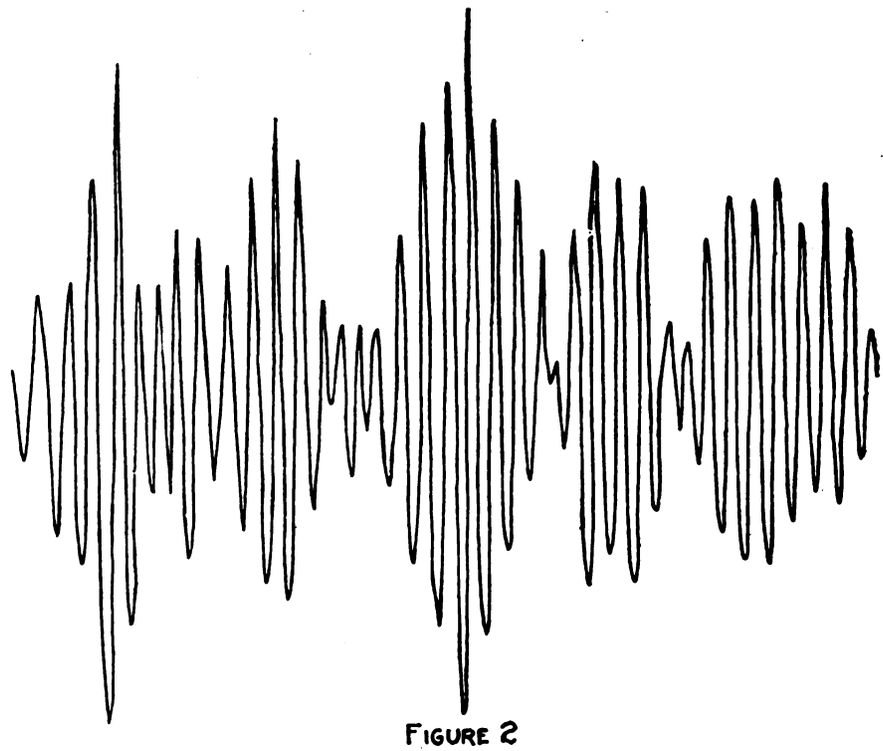

FIGURE 2

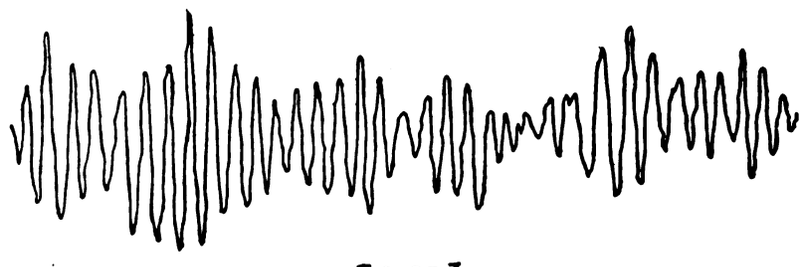

FIGURE 3

FIGS. 1, 2 AND 3—CURVES OF UNDAMPED ROLLING OF SHIP IN DIFFERENT SEAS

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and this approach or the percentage of the departure where they fail grows smaller and smaller as the seas grow heavier. Many curves have been analyzed with the tanks placed high, if not higher, and with the damping effect placed practically upon the conditions of the Ypiranga and Corcovado, where these tanks are placed at the highest point relative to the center of oscillation so far recorded. Upon an examination of these curves shown in Figs. 4 to 7, we discover that a departure of about 13 per cent in a comparatively calm sea, and of only about 9 per cent in a heavy sea, is sufficient to practically nullify the usefulness of the tanks.

*Planimeter Analysis*

A careful planimeter analysis of these curves which take into consideration the sum of all rolling motions of the boat over a given time, show that where the natural roll is given as 100 in each case, and under identical conditions, the rolling with all tanks in service amounts in Fig. 4 to 80; in Fig. 5 to 730, and in Fig 6 to 68; whereas Fig. 7 shows that under full operation of the two damping tanks the area is 73.2. And in this latter case the departure of the wave impulse from true synchronism has only been 9¼ per cent. We can by no means consider any such performance as this as stabilizing the ship, nor in any sense of the word fulfilling the object before us; nor can it be considered as justifying the large burden in weight and the great amount of valuable space occupied amidships, in the position where space is most available and valuable for other purposes.

Again referring to the recorded action of these tanks, I do not think any of us would consider the performance shown in Figs. 4 to 7 as coming under the head of extinguished rolling or justifying the large expenditure of funds or of the boat's carrying capacity as stated.

It is sufficient to say that experience had demonstrated that damping tanks are disadvantageous, if not positively dangerous, when out of synchronism or when their period is not adjusted to that of the ship and, when so adjusted, then at each time the phase changes. In this connection it will be of interest to note that the period of the ship varies with its speed. A change of 30 per cent has been noted between period of a ship at 15 knots and that at 0 knots speed, thus showing that the period undergoes changes from more than one disturbing factor.

The stabilization of ships has been undertaken by two methods:—First, by changing the center of gravity of the mass as a whole, as by the damping tanks of Sir Philip Watts and later workers, and the moving weights already successfully applied by Sir John; and second, by employing the already very great longitudinal stability or rigidity by deflecting same in to the athwartship plane. The ship by this means may be rendered stable almost without limit and up to the breaking-down point of the gyroscopic couple, which has now come to be recognized as of simple origin and of very great magnitude, especially as compared with the weights involved.

Some of the early attempts to use the gyroscope were unfortunate in that the gyro was passive, therefore free and uncontrolled as to its precessional movements. Experience has now been had in actual sea trials which confirm statements often put forward by the author heretofore, urging the great importance of having these precessional movements of the gyro at all times under perfect control. This arrangement introduces into the art a number of very important advantages which are now of definite and proven worth. This control on the one hand sets a constant limit to the otherwise almost limitless power of the gyro couple, while on the other hand it allows us to apply a measured stress of any desired magnitude, duration or direction and timed with precession. In this manner, the very great longitudinal metacentric height is available for athwartship purposes and may be in any desired amount added to the athwartship component. In fact the point has now been reached in this development, as demonstrated by sea trials, that the amount of the great longitudinal stability utilized athwart-

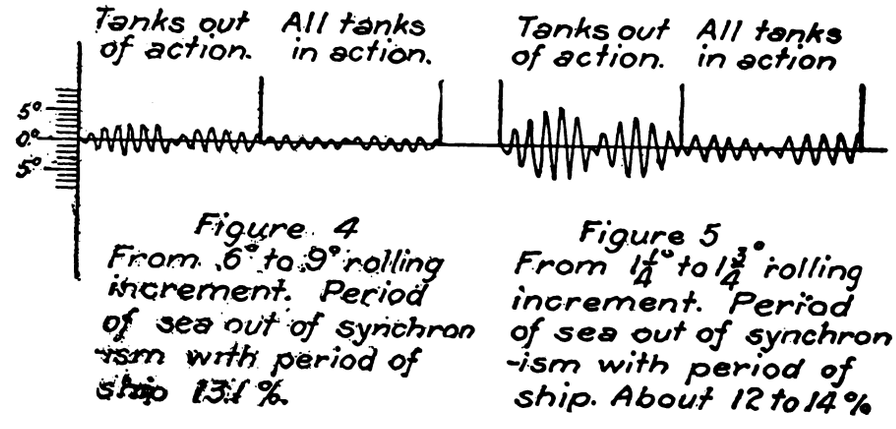


Figure 4
From 6° to 9° rolling increment. Period of sea out of synchronism with period of ship 13.1%.

Figure 5
From 1¼° to 1¾° rolling increment. Period of sea out of synchronism with period of ship. About 12 to 14%

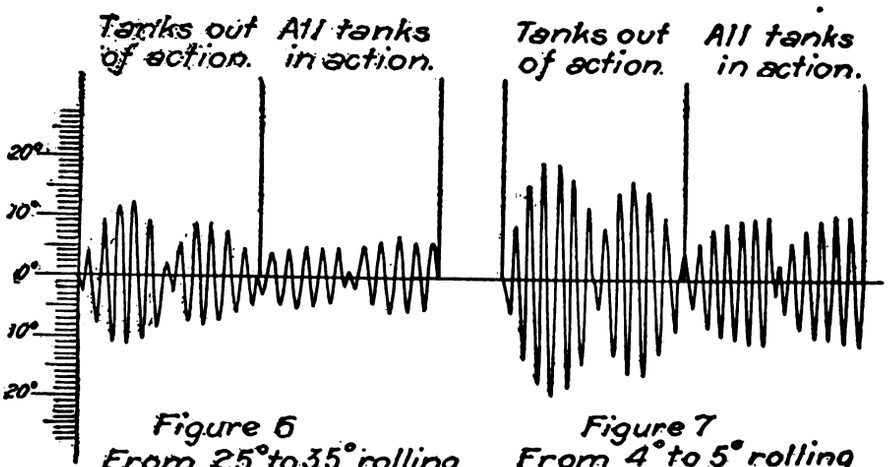


Figure 6
From 2.5° to 3.5° rolling increment. Period of sea out of synchronism with period of ship 12.8%

Figure 7
From 4° to 5° rolling increment. Period of sea out of synchronism with period of ship 9¼%

FIGS. 4, 5, 6 AND 7—CURVES SHOWING ACTION OF DAMPING TANKS

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ship may be always quantitative and proportional to the needs. With the adjunct the ship itself may be very tender and of low metacentric height because, as above stated, any desired amount of the very great longitudinal metacentric height may be added at will athwartship, and this without any regard to the rolling period of the ship. In this manner a comparatively small apparatus can be utilized in effectually holding the ship against motion, simply because each increment on the instant, and simultaneously with its development, is completely subjugated and neutralized before it has time to move the ship.

### *An Ideal Apparatus*

The gyro constitutes an ideal apparatus for this work inasmuch as it is perfectly safe. It is unnecessary to run the wheel at any but comparatively low stresses. In fact, the stresses present can be brought below those used in hull practice. The comparatively slow motion of the wheel is very inexpensive to develop and maintain, representing only a small fraction of the power required to propel bilge keels; and this power, small as it is, is only required when the necessity for stabilizing arises and then only in proportion to the seas running at the time, whereas the power for the bilge keels is omni-present; that is, it is a constant drag in all weathers. The power for operating the precession is trifling, only sufficient to absolutely control and limit the precession movements at all times. This arises from the fact that the constant tendency of the ship is to do precession-wise work upon the gyro.

The power required for the precession engine is almost nil, it being only sufficient to control the implacement of the positive and negative energizations delivered to the ship.

It must be remembered that the weight of Thornycroft was specifically seven times that of the water in the tanks. The gyroscope is ideal in another sense, for here we have the weight of Thornycroft greatly augmented as to mass moment by the simple fact that it is in rotation, which constitutes a multiplier of tremendous magnitude, even though the actual rotative speed is comparatively low.

That Thornycroft was correct in his line of attack on this problem has now received emphatic confirmation. The effectiveness and mass moment of his weight have been mightily augmented on the one hand while on the other decreasing its gravity load upon the ship and at the same time never shifting its position with regard to the ship or changing the center of gravity of the latter in the slightest degree. If all these things had originally been in the hands of our distinguished contemporary it is impossible to predict the very great advance that the art of stabilizing ships would have by this time achieved, as only last year he stated:—"I came to the conclusion 20 years ago that it was possible to make ships perfectly steady."

In connection with dealing with each individual increment, let us for a moment again refer to Fig. I. As we trace the envelope of these curves in their rise and fall, as they are near the center line where the phase is usually shifted, there is always the first impulse of a new cycle, the one which sets the cycle. Now if no cycle of rolling ensued we would have simply a succession of these beginnings, which will naturally be of various signs and magnitudes. These are more numerous in a vigorous, choppy sea where, as stated, the cycles themselves are shorter and the individuals which shift the periods appear oftener. Now if each of these beginnings could be efficiently suppressed neither the cycles nor the individual rolling constituting these cycles would ever come into evidence, and it is just this suppression that we are enabled to effect by the gyro.

### *Small Magnitude*

The surprisingly small magnitude of the whole gyro equipment is due largely to its unique method of operation; that is, it makes up in activity and promptness what it may seem to lack in size and weight.

One important feature of the active type of gyro is its power to artificially roll the ship on which it is mounted.

This feature is of great value when applied to ships in icebound waters, inasmuch as it enables them to keep free of the ice. In the case of the S. S. Ashtabula, we have a ship of about 5,000 tons displacement plying regularly between ports of this country and Canada across Lake Erie. Her general dimensions are as follows: Length, 370 ft.; beam, 56 ft.; displacement loaded, 4,500 tons; draught, 11 ft.; period, from 5.5 to 6.6 seconds. In stormy weather she has rolled in the neighborhood of 35 degrees or through a 70-degree arc. In this instance and on Lake Erie this rolling is usually due to a succession of comparatively small increments, the magnitude of which has been ascertained.

In Figs. 7, 8 and 9 are shown an active gyro and damping tanks of equivalent stabilizing power which have been carefully calculated from known formulae, the analyses of which have been brought to conform exactly to the formulae of Herr Frahm. These formulae have also been used in the diagrammatic analysis. The metric system has been used throughout to facilitate the comparison. The period of this ship varies from 5.6 to 6 seconds according to the number, weight and distribution of railway cars upon her four tracks. The total net load capacity of this vessel is about 1,500 tons. The tanks in each instance have been designed for taking care of one-degree wave slope increment. Since the trips are of comparatively short duration and the load varies through quite a large range, the adjustment of the tanks would be imperative to bring them into synchronism. There would be no reserve quenching power available in the tanks shown, the free space necessarily being small. There being no available space above the main deck for the tanks, they are placed below.

Keeping the characteristic displacement × period × M. G. constant, we have the following results as to tanks and gyro:—

COMPARISON—DAMPING TANKS AND EQUIVALENT GYRO STABILIZING PLANT. S. S. ASHTABULA.

| | | Tanks. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Weights in metric tons. displace- | | | Percentage of | | | Capacity |
| Period of roll. | Notes. | Water. | Tanks. | Total. | ment. | Space requir'd. cu. mtrs. | cu. ft. | for rolling ships. |
| 6 sec. | Two tanks 60 and 40 ft. long | 784 | 95 | 897 | 19.8 | 960 | 33,180 | none |
| 6.6 sec. | Two tanks 40 and 20 ft. long | 490 | 65 | 555 | 12.4 | 626 | 21,600 | none |
| | Complete gyro equipment. | | | | | | | |
| Any period. | One plant | ... | .. | 51 | 1.1 | 64 | 2,200 | * |

*Through an arc of 8 degrees to 10 degrees.

Even with these tanks it is doubtful whether sufficient resonance can be developed during the time when the boat has less than a 6-second period in the one case, or 6.6 seconds in the other.

In the Ashtabula extreme space requirements are not of great importance, but the extra weight of the tanks and water would probably interfere with the boat's clearing the bar on the Canadian side. In Fig. 8, the tanks for the 6.6-second roll are shown, together with the diagrammatic analysis of their action, and there is also given a scale outline of a single gyro which will yield much more than the equivalent stabilization

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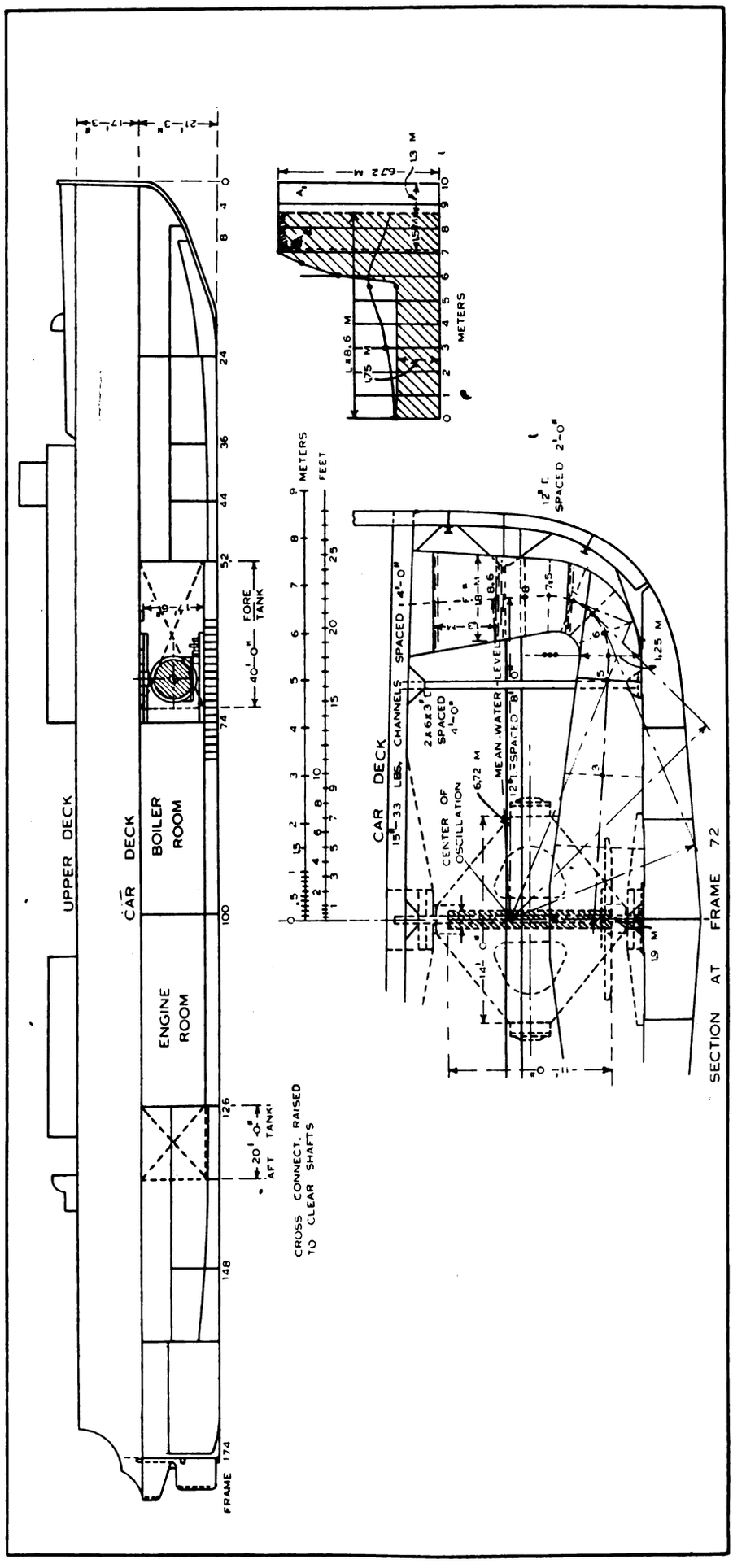


FIG. 8—CAR FERRY ASHTABULA (Period 6.6)

to the boat, with an extremely low maximum stress of the wheel, the gyro in its action being entirely independent of the period of the boat.

Fig. 9 shows tanks having the same damping factor, namely, one degree of wave slope, for a 6-second period of the Ashtabula. The extreme size and weight of these tanks are apparent and they stand out in still greater contrast to the gyro equipment.

*Elastic in Design*

Again we find that the gyro is quite elastic as to design and can be made smaller and broader, wide or narrow, to fit spaces available. The weights given are for all parts, including foundations, strengthening and bracing, and the space requirements are outside of that actually used.

The very low maximum stress of only 6,250 pounds per square inch is present in this wheel and this at only one point in the wheel.

Should we select a larger maximum stress for the wheel, then the gyro plant is considerably decreased over the above figures. This wheel can easily be made to give nearly double the roll quenching power.

Even in this extremely stiff ship, requiring relatively an unusually heavy gyro, the differential as to both weight and space stands out in favor of the gyro in marked contrast to the tanks. This is especially true when it is understood that the tanks will only function or perform half, and the more unimportant half, of the work easily performed by the gyro; that is, the tanks are only serviceable for stabilizing, whereas the gyro is originally intended for producing roll in the ship to prevent the ship from being caught in the ice or freezing solid in the process of forcing her way through heavy ice fields and especially windrow ice during the winter and spring months. For this latter purpose, however, it is found that a small gyro will perform all those functions, that is, the gyro illustrated here, while ample for stabilizing the ship, is much larger than is required for rolling. The gyro illustrated would only require to be run at one-third or one-half speed for the production of all the rolling that could ever be required by the Ashtabula in breaking through the heaviest ice. This is owing to its incessant action developing its full force in proper direction and with the proper emplacement upon each half period. Very heavy rolling can easily be produced and maintained. The action under these conditions is far simpler than in preventing roll, inasmuch as the reaction of the ship

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after rolling has started is found to react back to the gyro sufficiently to automatically control its precessional movements; usually in rolling only fractional speeds of the gyro are used.

*Mr. Sperry's Paper Discussed*

**Bradley A. Fiske:**—I have read the paper by Mr. Elmer A. Sperry, called "Active Type of Stabilizing Gyro," with great interest and pleasure. What Mr. Sperry has accomplished already is most remarkable; and even if he does not succeed in accomplishing everything that he is attempting, it seems sure that he will accomplish enough to make him a benefactor of all "who go down to the sea in ships."

I went on board the Worden about three weeks ago, when she was rolled, and then steadied, by Mr. Sperry's active stabilizer. I was on board 20 minutes, and when I left, I was about one-quarter seasick, and no doubt was left in my mind that Mr. Sperry can roll any ship, and stop it when rolling; provided he can employ apparatus of sufficient power.

Whether Mr. Sperry will succeed in accomplishing all the great things that he is attempting, I am, of course, unable to predict; but it is certain that it would be extremely desirable that he should succeed, and therefore that he should be given all possible encouragement.

I have also glanced over the paper of Mr. Gillmor, called "The Sperry Gyro-Compass in Service." Mr. Sperry's gyroscope compasses are fitted in the Florida, and I am very glad of the opportunity of testifying to their great efficiency for the purposes intended, and their value in naval work. Mr. Gillmor is very optimistic, but in my opinion, he is not too optimistic.

**F. L. Dubosque:** The discovery by Mr. Sperry of a device that will prevent the rolling of ships at sea, which this paper really shows, comes to us with such suddenness and surprise that its effect is not fully realized.

It was my privilege to see the gyroscopes mounted on the torpedo boat destroyer Worden to see how they could cause the ship to roll at the will of the operator and how they could with suddenness check this rolling motion after the motion had been set up, and it seems to me that Mr. Sperry has discovered a new force in so far as its effect upon ships is concerned. The earth's motion and the motion of the heavenly bodies from which Mr. Sperry has absorbed the laws governing rotating bodies have a precessional movement in the path of their orbits, and a force in a horizontal direction similar to this is exerted by a gyroscope when rotated on a horizontal axis. The

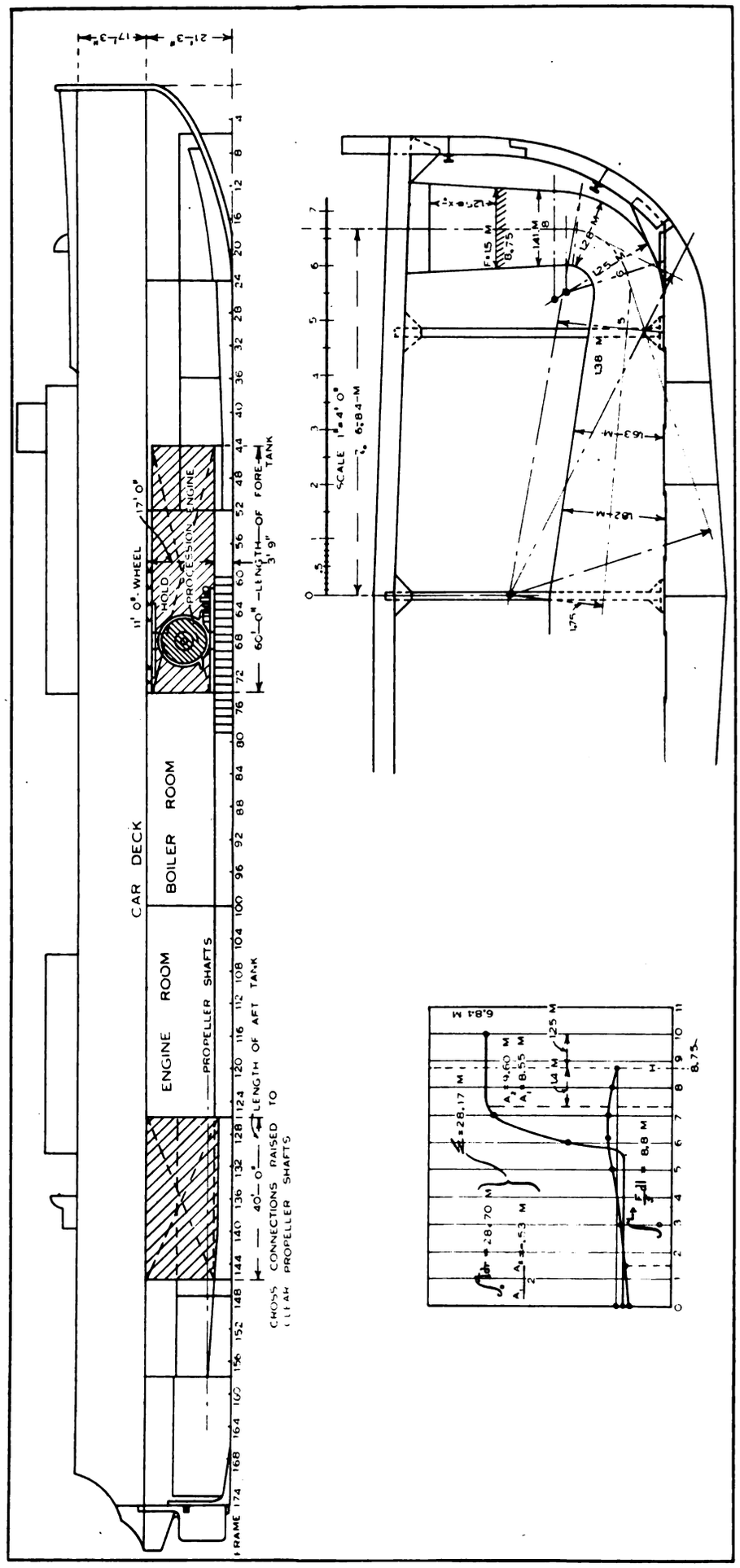


FIG. 9.—CAR FERRY ASHTABULA (Period 6.0)

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amount of the force is dependent upon the speed and weight of the gyroscope and the direction in the horizontal plane is easily controlled.

Mr. Sperry has determined by experiment and calculation the force exerted by this precessional movement of the gyroscope and is able to decide the size of machine and the speed of rotation required to produce any precessional force. It can easily be conceived, therefore, that when the force required to list a vessel to any degree is known it is possible to install the proper type of gyroscope to prevent this listing action. It must be borne in mind, of course, that the movement of the gyroscope to prevent listing must anticipate the listing action and its direction, and Mr. Sperry proposes to accomplish this by installing a very sensitive gyroscope pendulum that, acting on suitable devices, causes the main gyroscope to slowly oscillate on its vertical axis in the proper direction at the instant the vessel heels to the slightest degree. It is not likely, therefore, that a vessel can be maintained in a constant upright position, but undoubtedly the angle of heel will be very small and not sufficient to cause annoyance to passengers. In this respect the gyroscope is undoubtedly superior to rolling tanks that have been experimented with considerably in the past, and it seems to me that the author of the paper has in a practical and commercially possible way provided the long sought for device that will prevent the annoying rolling of ships.

*Theory of Rolling*

**Rudolph Blohm:**—The object of my speaking is to call your attention to some facts, mentioned by Mr. Sperry concerning the theory of rolling. Dealing with the question of primary resonance between waves and ship, Mr. Sperry said: "There is no such thing as resonance between waves and ship," and from this statement draws the conclusion that any anti-rolling device, relying for its effectiveness on the existence of secondary and artificial resonance, will not dampen in the ordinary sea conditions. Even if we assume that there will be heavy rolling of the ship without resonance between the periods of the waves and of the ship, this, of course, would only be true if the ship itself should not retain its individual rolling.

As soon as it is proved that the ship always has the same or nearly the same period, the effectiveness of the tanks would not be affected by the absence of the primary resonance between waves and ship. Now, on page 5, Mr. Sperry doubts the fact of a constant rolling period of the ship, saying that he noted a change of 30 per cent between the period of a ship at 15 knots and at 0 knots, but he does not say anything on the law governing the dependence of the rolling period upon the speed. Similar doubts were uttered during the discussion before the English Institution of Naval Architects in 1911, which dealt very largely with these questions, and from which Mr. Sperry quotes at different times in his paper. At the end of the discussion, Herr Frahm said: "I have had before me quite a number of rolling diagrams recorded on board of all sorts of ships, tender and stiff, which proved the correctness of my assertion. (As to ships rolling only in their individual period.) In fact, all these ships the displacement of which varies from 1,200 to 30,000 tons, when rolling considerably have always maintained their individual period and only trifling differences, which rarely came to more than 5 per cent, have been observed." There may be a change, however, in the period of the waves, in resonance with the period of the ship. This may easily be seen when considering that the ship steaming against the waves at a certain angle, receives more impulses from waves of a certain period than a ship struck by oblique waves of the same period coming up from behind. In both cases, however, the period of the ship remains the same, and the tanks therefore will be effective.

*Primary Resonance*

If Mr. Sperry denies the existence of primary resonance, there is still another question to be considered: Is the ship rolling at all to a considerable amount if there is no resonance between the waves and ship? Since the ship as a whole is rolling in exactly the same way as an ordinary pendulum, the simple, well known experiment of the double pendulum will prove to you that there will be no heavy rolling if there is no primary resonance between waves and ship. In this experiment the second pendulum is only swinging heavily if it has the same period as the first pendulum from which it receives the impulses. The second pendulum will make small irregular oscillations only, in both cases, if its period is shorter or longer than that of the first pendulum. During the reading of his papers before the foreign societies in 1911, Herr Frahm attached a third pendulum to the second, the first pendulum, which received regular impulses, now representing waves of a given period, the second representing the ship and the third the water in the tanks. By changing the length of the second and of the third pendulum and thus establishing conditions of resonance of shorter or of longer periods of the ship and the tank water, Herr Frahm thus clearly showed that all oscillations not caused by resonance are of a very small amount only. This has been confirmed by rolling diagrams taken from tank experiments as well as from a great number of ships. On Plate 17 of his above mentioned paper, Herr Frahm has published curves from tank experiments, showing the behavior of a ship when struck by quite irregular impulses, their period varying from 5 to 11. The diagrams taken on board of ship also show that forced oscillations of ships caused by waves of a different period make the ship swing quite irregularly, but do not produce heeling amplitudes comparable to those of natural rolling. Even on smaller vessels these amplitudes scarcely amounted to more than 5 or 6 degrees. I think the same conclusion might be arrived at from Mr. Sperry's own words? If he doubts the effectiveness of tanks in "instances only slightly removed from synchronism" why then does he assume heavy rolling of a ship if "there is no such thing as resonance between waves and ship"? The conclusion to be drawn is that any anti-rolling device has to be designed only for the case of resonance.

*Out of Synchronism*

To prove his statements of the ineffectiveness of the tanks upon conditions where the sea is out of synchronism with the period of the ship, Mr. Sperry takes the curves on Plate 2 of his paper. I think these curves, showing the rolling amplitude of the ship for a very few minutes only, extend over a time much too short to give a fair view of the usefulness of the tanks. The original curves from which Mr. Sperry has taken the curves shown on Plate 2 are published in Herr Frahm's paper and extend over a period of several hours for each instance. Moreover, they are taken at different loading conditions of the two sister ships Ypiranga and Corcovado, which, of course, affect the period of the ship. The periods indeed vary from 3.73 to 4.61 oscillations per minute in the case of the Ypiranga, and diagrams taken for different periods of the ship prove that the great usefulness of the tanks is not considerably affected by the change in the period of the ship. The reduction of the amplitudes is in one instance from 11 degrees to 2½ to 2 degrees, in another instance from 18 degrees to 4 to 3 degrees, and with only one tank in action from 18 degrees to 7 degrees, which is much more than in the curves on Plate 2 of Mr. Sperry's paper. Since some of Herr Frahm's paper have been taken in a very heavy sea gale, I think Mr. Sperry's assertion that "the percentage of the departure where they fail grows smaller and smaller as the sea grows heavier," is not justified, and I am sorry Mr. Sperry did not publish any data or curves to prove his words. "we find that the tanks have already practically failed to perform any useful function whatever." Since the time of

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the publication of Herr Frahm's paper, rolling diagrams have been taken on a great number of ships, all of them showing a very large reduction in the heeling amplitudes, though the tanks have never again been placed as high as in the case of the Corcovado and the Ypiranga. In the Kaiserin Auguste Victoria, of the Hamburg-American line for instance, the rolling amplitudes in a very heavy storm were reduced to 33 per cent of their amount when the tanks were not in action. This is no specially selected example, but one which just occurs to me.

*Adjusting the Oscillations*

As to Mr. Sperry's words on page 5, that "it is sufficient to say that experience has demonstrated that damping tanks are disadvantageous, if not positively dangerous, when out of synchronism." I want to say that it is a special feature of the new devices of anti-rolling tanks that they are fitted with an air pipe, connecting the tanks on both sides of the ship, and that this pipe has a valve which may be closed. In this case, there will be no free water surface, as in the earlier anti-rolling devices of Sir Philip Watts, Prof. Biles and others, where the water was allowed to rush through from one side of the ship to the other. In the Frahm tanks the movement of the water can at any moment be controlled by blocking the air connections and, by throttling the air, the oscillations of the water may be adjusted to the conditions of the sea. So there is positively no danger connected with the water in the tanks. I think the best proof concerning the reliability of anti-rolling tanks is the fact that the Hamburg-American line has already installed, or is installing the Frahm tanks into all of its big ships, including the Imperator and her two sister ships of 55,000 tons each. Nearly all other important German lines running passenger steamers are installing them. The Cunard line also is fitting these tanks into its largest and latest ship, after having given them a thorough trial in the Laconia, commissioned last year. I do not believe that the responsible men of these companies would take the risk of installing the tanks if there were any danger connected with them.

**Elmer S. Sperry:**—I regret to say that I did not hear all of Mr. Blohm's discussion. Undoubtedly, I can have access to it subsequently, and I can then have the pleasure of answering it. I did not say that the dampening tanks do not dampen, but I say that the dampening tanks also require a certain amount of motion to set up their reaction.

# Panama Canal Lighting Plan

***Walter F. Beyer* Outlines the Plan of Illuminating the Great Waterway***

THROUGH the courtesy of Mr. James MacFarlane, one of your members, I had the privilege of reading the advance copy of a paper on "Marine Lighting Equipment of the Panama Canal", by James Pattison, read at the twentieth general meeting of the Society of Naval Architects and Marine Engineers.

Mr. Pattison's paper is interesting and illuminating in so far as it pertains to the gas buoys adopted for the Panama canal, and descriptions of the various mechanical features which have made the use of compressed acetylene dissolved in acetone safe and reliable for lighthouse purposes; but his introductory remarks are misleading and give the impression that the illuminant for all the aids to navigation on the canal will be compressed acetylene dissolved in acetone.

Inasmuch as your society has accepted Mr. Pattison's paper and that it will receive considerable publicity, it appears to me that the approved project for lighting and buoying the canal should be placed before the members of your society in the nature of a criticism, in order to avoid misapprehension on the part of all concerned.

On page 1 of the printed advance copy Mr. Pattison fails to qualify his opening paragraph by stating the illuminant to be used for the various lights and on page 2 he fails to state that Ambrose channel and Delaware river channel are only partly lighted by the system of compressed acetylene dissolved in acetone.

On page 3 he fails to stipulate that the final coats of paint for the exterior of the buoys will be an anti-fouling paint for the salt water buoys and a special paint which will resist the action of the waters in Gatun lake for the fresh water buoys.

A brief synopsis of the approved project follows:

The Panama canal consists of 23 tangents. The scheme of illumination includes range lights to establish direction on all the longer tangents, while side lights, with intermediate spar buoys one mile apart, mark the edge of the channel. The range lights are omitted in Culebra cut, where their use is hardly practicable, and on seven of the shorter tangents.

The project also includes a light and fog signal station at the end of the west breakwater in Limon bay, a light on the east breakwater should it be built, and gas and nun buoys lighting and marking the channel to Mount Hope dry dock at Cristobal.

The proposed aids to navigation are numbered in the order in which they are used in passing from the sea on the Atlantic side through the canal to Miraflores locks, and from the Pacific side in like manner to the same point. In order to simplify the numbering, however, the canal and its approaches are divided into natural districts as follows:

Atlantic section: From breakwater light to foot of Gatun locks.

Gatun lake section: From foot of Gatun locks to Bas Obispo.

Culebra cut section: From Bas Obispo to Pedro Miguel.

Miraflores lake section: From Pedro Miguel to Miraflores locks.

Pacific section: From Pacific ocean to Miraflores locks.

**JAMES PATTISON.**

James Pattison was born near Glasgow, Scotland, in 1879, receiving a public school education. He served a four years apprenticeship as marine engineer with John Brown & Co., Clydebank, afterwards entering the drawing office. About ten years ago he was engaged as mechanical engineer with the International Marine Signal Co., of Ottawa, Can. Subsequently he entered the department of marine and fisheries of the Dominion government, assuming charge of lighthouse work at the principal depot at Prescott, on the St. Lawrence river. In 1910 he joined the American Gasaccumulator Co. as sales manager, in which capacity he continued for three years. He is now the sales manager of the Oxweld Acetylene Co., eastern branch, New York.

*Walter F. Beyer is engaged in the service of the Isthmian canal commission at Balboa, Canal Zone.

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All the ranges, except the Atlantic and Pacific entrances, will be so placed that ships after entering the canal will follow a sailing course 125 ft. to starboard of the axis of the channel; thus two ships in passing will be 250 ft. apart, center to center, and each will be running on a range ahead, thereby obviating the necessity of turning out when passing each other.

The entrance tangents, however, have the range on the center line and vessels will use the same ones whether entering or leaving the canal.

For marking the short tangents and for referencing the location of gas buoys, reinforced concrete targets will be used.

*Range Towers*

The range towers are all of reinforced concrete and are of two general types. Those for the Atlantic and Pacific divisions, and for prominent places in the Gatun lake section, are of a more ornate description, while those for the Gatun lake section are very plain and inexpensive. The heights of the range towers vary from 28 ft. to 105 ft. from base to focal plane.

*Beacons*

Where the shore line approaches close to the edge of the canal, the side lights are placed on reinforced concrete beacons.

These beacons are cast at the central plant in three parts—the body, the roof, and the post for the lantern. The foundations will be prepared for these and then a derrick barge will take them out and set them up in place, with the parts laid in mortar.

At the Pacific entrance the type of beacon is different from the general type because of the great range of tide, which is 20 ft., and the low banks. It consists of a steel frame work encased in concrete and supporting a reinforced concrete watch room and a lantern post. The foundation is a group of reinforced concrete piles capped with a concrete slab on which rests a small reinforced concrete caisson.

*Buoys*

As stated above, the sides of the channel, in deep water will have lighted buoys about every mile with intermediate spar buoys. Each buoy will consist of a cylindrical, floating, steel body surmounted by a steel frame, which supports a light and lens at a height of 15 feet above water level. The body is 8 ft. in diameter, made of 5/16 in. steel plate with dished heads, to the bottom of which is attached a steel tube and counterweight. The draught of the buoy will be 12 ft., and it will be moored on its station by a heavy chain and a concrete sinker.

The corroding action of the salt water and the sea air in the tropics is such that extra precautions must be taken to protect the buoys, and therefore the entire inside of the buoy is given first one coat of bitumastic solution, applied cold, and second, one coat of enamel applied hot.

The exterior of the buoys which will be moored in salt water will be given one coat of boiled linseed oil applied hot and two successive coats of the best quality red lead, after which they will be treated with an anti-fouling compound.

The entire bed of what will be Gatun lake, when the water is allowed to rise to an elevation of 57 ft., is covered with a dense tropical growth which in the state of decomposition causes the water to scour all ordinary paints off any kind of metal. To overcome this chemical action the exterior of the buoys will first be painted with red lead and linseed oil after which they will be painted with anti-corrosive paint.

*Targets*

On the short ranges, and at certain points along the lake channel, targets will be built to mark the center line of the canal or to reference the lighted buoys, as the case may be. These targets will consist of a tripod 20 ft. high made of steel angles encased in concrete, and the upper 8 ft. of the tripod will be filled in from leg to leg with a plaster wall of metal lath. This furnishes a fairly uniform target from whatever angle viewed and is permanent and inexpensive.

*West Breakwater Light*

In the general scheme for lighting the canal, a harbor light and fog signal station is to be built at the outer end of the west breakwater in Colon harbor. An "L" turning inward will be made at the end of the breakwater and the tower built in it so that thorough protection from the waves will be obtained.

The natural bottom of the harbor at this point is about 45 ft. below mean tide and is mostly silt deposited by the heavy rains washing down the hillsides. On this silt a pile of riprap for the sub-foundation will be dumped, allowed to settle for some time, and leveled off by a diver at elevation minus 22 below mean tide.

The sub-foundation will consist of a reinforced concrete caisson 46 ft. by 46 ft. in plan by 36 ft. high, divided into sixteen compartments by three transverse walls running each way.

The superstructure will be of reinforced concrete, and will contain an engine on the first floor, living quarters on the second floor, and a tower rising out of the center of the structure, surmounted by a lantern, the focal plane of which will be 56 ft. 4 in. above mean sea level.

In addition to a compressed air fog signal this station will also be equipped with a submarine bell. In this connection it may be stated that while there are practically no fogs at the Atlantic entrance to the canal, there are frequent and heavy rains which, with the aid of a fog signal, will lessen the difficulty of entering the harbor.

*Illuminants*

The illuminants will be acetylene gas and electricity, the latter being used in all towers and beacons convenient to a main line, and the former in all buoys and inaccessible lights. The candle power of the range lights will vary from 2,500 to 15,000 or more, depending upon the length of the range. The most powerful lights, visible from 12 to 18 nautical miles, will be those marking the Atlantic and Pacific entrances. The beacon and gas buoy lights will be about 400 candle power.

To eliminate the possibility of confounding the lights with one another and with lights on shore, all range lights, beacons and buoys will have individual characteristics formed by flashes of light and dark intervals.

In the electric lighted towers the burner is so arranged that, when the lamp in place burns out, it drops out of focus and a reserve lamp drops into its place, thus minimizing the danger of a light being extinguished. The mechanism is operated by a shunt and series coil, the latter of which is thrown out when the light goes out, thus allowing the shunt coil to operate a lever and so replace the burnt out globe with a new one.

*Aids to Navigation*

The number and type of aids to navigation employed in the project for lighting and buoying the canal is as follows:

One harbor light (west breakwater) lighted by incandescent oil vapor lamps or acetylene.

Fourteen range towers, lighted by electricity.

Eighteen range towers, lighted by acetylene gas.

Forty-six beacons, lighted by electricity.

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Three beacons, lighted by acetylene gas.

Fifty-nine gas buoys, lighted by compressed acetylene dissolved in acetone.

One hundred spar buoys (unlighted).

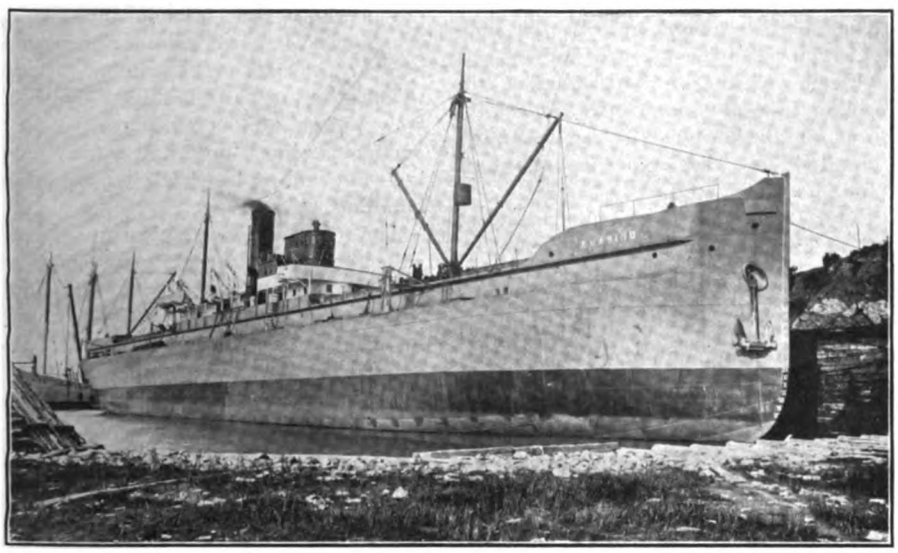
Two gas buoys, lighted by acetylene. (Channel to terminal docks and dry dock at Cristobal.)

Seven nun buoys, unlighted. (Channel to terminal docks and dry dock at Cristobal.)

At the present writing (November, 1912) contracts have been entered into only for fifty-seven gas buoys lighted with compressed acetylene dissolved in acetone.

## The Remodeled Turret Bell

An interesting side light on the condition of the shipping market in Europe is furnished by the reconstruction of the steamer Turret Bell, at Levis, Que., during the past summer.



THE RECONSTRUCTED TURRET BELL NOW THE KWASIND

This steamer was stranded on Prince Edward Island, and was abandoned to the underwriters as a total loss. After some unsuccessful attempts by local wrecking companies to float the vessel, a contract was made with the Reid Wrecking Co., of Sarnia, Ont., who finally floated the vessel and brought her up the St. Lawrence to Levis under her own power, where she was placed in dry dock for survey. After having lain at Levis for some time a company of Boston capitalists, interested in coal mining in Europe, having canvassed the market for suitable ships for their purposes, found such a dearth of tonnage, and anything which might be had held at such high prices, decided to purchase the Turret Bell and have her repaired and refitted.

The work was put in charge of Alexander Hynd, consulting engineer, of Cleveland, and the vessel was taken to the plant of Messrs. Geo. T. Davie & Sons and the preliminary work started. On June 17 she was placed in the government dry dock at St. Joseph, Que., where the general repairs were carried out. The vessel received practically a complete new bottom of plating, frames and floors, and a number of alterations were made in structural features to facilitate handling of cargo, etc. The main and auxiliary machinery and boilers were thoroughly overhauled and repaired and the rudder demounted and refitted with all new pintles and bearings. New and commodious quarters were also fitted up for crew and officers, with metal berths throughout, and all equipped with modern conveniences for comfort and sanitation. The vessel was rerigged throughout, and the cargo gear completely overhauled and refitted for handling clam-shell buckets for unloading coal cargoes, the winches being reconstructed for this purpose and fitted with double drum friction gearing. A modern electric light plant was also installed, including a system of lights for handling cargoes by night and a powerful search light. Modern systems for heating and plumbing were installed and complete new furnishings and outfit supplied throughout, and new metallic lifeboats fitted.

On completion of alterations, the vessel was renamed the Kwasind and on leaving Quebec, Oct. 3, was to all appearances a new vessel. The Kwasind loaded a cargo of deals at New Mills, N. B., which was delivered at a British port, and she is now engaged in general business, pending the time when she will take up her special line of work in June of next year.

The illustration shows the Kwasind lying in the slip of Messrs. Geo. T. Davie & Sons' plant, at Levis, after completion of the repairs and just before making a trial trip in the St. Lawrence, Sept. 29.

## Union Gas Engines

The New England Fish Co.'s splendid 90-ft. halibut boat, Pescawa, is having a 100-H. P. open cross-head type Union installed by Taylor & Young, who are now the Vancouver agents for the Union Gas Engine Co. The Pescawa has a gross tonnage of 97.6, and with her fine lines and the above power equipment should prove a most satisfactory boat.

The Emma H, also owned by the New England Fish Co., recently had a 100-H. P. Union installed, and the new Union inlet manifold has made the handling of the boat practically as flexible as a steam outfit.

Wilson Bros., of Astoria, have installed the following Unions: Four H. P. single cylinder marine, 8 H. P. two cylinder, and 20 H. P. two cylinder marine engines.

Taylor & Young, of Vancouver, report the sale of a 35 H. P. three-cylinder Union to the Canadian government, to be installed in a launch; during the past few weeks they have sold the following Unions: Two 16-H. P. two-cylinder marine, two 35-H. P. three-cylinder marine, two 100-H. P. three-cylinder marine.

The 500-H. P. Union which is being constructed for the Oakland & Antioch railroad ferry boat is progressing rapidly, and should be completed shortly after the first of the year. This engine will be watched with a great deal of interest, for it is the largest unit that has ever been built. The engine has eight cylinders, weighs 120,000 lbs., and is more than 40 ft. long over all. The boat is about the size of the present Key Route boats.

The 150-H. P. four-cylinder Union recently ordered by the Union Fish Co. has been completed, and will shortly be installed in their new schooner being built by Frank Stone at the Union Gas Engine Co.'s yards.

The three steamers building at the Lorain yard of the American Ship Building Co. for the Standard Oil Co. will be named Comet, Radiant and Brilliant.

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# Fuel Economy and Ship Design

## *The Influence of Design Upon Fuel — Value of Experimental Tanks*

By E H Rigg

IN RECENT years we have witnessed great progress in marine engineering; new types are striving for first place, each having its advantages and its advocates; geared turbines, oil and gas engines, electric transmission and other schemes, each offering economies of fuel and therefore lesser operating expenses.

The latest transactions of the technical societies concerned each contain papers bearing on the subject, especially that read before the North-east Coast Institution last April and that on the geared turbines on the channel steamer Normannia read before the Institution of Naval Architects this year, to say nothing of many important papers read elsewhere.

These all point out the possibilities of economy from the point of view of machinery savings. It is the object of these notes to point out possible economies due to efficient ship design, because savings are being made by naval architects, as well as by marine engineers.

Cheapness of operation is one of the necessities for commercial success in a competitive age. The problem of evolving economical ship forms is an intricate one, and a study of the records of this society will show that much time and money have been spent in the pursuit of efficient forms, which is another way of saying economy.

Experimental tanks have been built in all the leading maritime countries, and commerce is slowly but surely beginning to reap the benefits. Not only has ship form come in for the attention it deserves, but we have lately witnessed renewed efforts to solve propeller problems, so necessary to keep up with the higher speeds of revolution demanded by the new types of propelling machinery.

It is at once evident that the naval service has reaped the greatest benefit of the study devoted to ship propulsion; perhaps this is only natural, the pioneer experimental tank in our country being the government one at Washington. That this tank pays is evidenced by the difference between the Connecticut trials and those of the Michigan. The average ship of the Connecticut class required 15,700 indicated horsepower for 18 knots, whereas the later design, of identical displacement and type of machinery, required only 13,100 indicated horsepower for the same speed. This means that for 10,000 miles the saving in coal amounts to some 1,100 tons at 18 knots; this can be fairly credited to the experimental tank and its able staff.

Our destroyer designs are also good examples of efficient propulsion; the way in which the recent vessels have gone through their trials compared with those of 12 years ago needs no comment.

### *The Best Speed*

The best speed at which to run a merchant vessel is not a question that the builder has much to with. The distance between ports, proportionate values of passenger and freight business, the nature of the cargo, mail-carrying requirements, character of the waters traversed, and the competition to be met are the prime factors in determining this speed. Once it has been decided upon, the builders should be allowed to settle the dimensions best suited to the speed and the work (passenger and freight accommodations) expected of the vessel. It is surprising how many vessels are run at unsuitable speeds, some unavoidably so on account of passenger accommodations; but the majority could well have been reconciled in the design stage as regards the dimensions, speed, capacity, stability, trim and deadweight.

When the owners decide on their real service speed, the builders should not be required to run a measured mile trial reaching a top speed out of all proportion to the service speed; it can only be done at a sacrifice of efficiency elsewhere, probably in the firing of the ship and consequent reduction in carrying capacity.

In fast passenger liners the proper reconciling of speed and dimensions may very well spell success or failure to the whole venture; this should be recognized and some time devoted to preliminary design work and model tank tests. The preliminary work on the Mauretania designs furnishes a case in point. Why should not corresponding care and attention be devoted to less ambitious designs? That many owners are seeking to get the maximum out of their investment is evident when we consider the number of special types lately coming to the front, all designed with a view to the utmost efficiency in their particular line, not only for driving but more especially for cargo handling and storage.

The following examples have been collected from recent experience in general design work, with the hope that others will be brought forward in discussion by those whose daily experience has been along similar lines.

### *Example No. 1*

Advantage of model tank experiments on hull forms and of careful propeller design.

The data below can be vouched for, the two vessels being tried over the same course, Delaware breakwater; both were deep load draught trials and progressive runs were made.

The figures below speak for themselves:—

| Item. | Year of Completion 1903, ft. in. | 1909, ft. in. |
|---|---|---|
| Length | 360 0 | 385 0 |
| Breadth | 46 3 | 53 0 |
| Draught | 20 7 | 24 8 |
| Displacement in tons | 7,700 | 11,260 |
| Block coefficient | .786 | .784 |
| Propulsion, system of; screw | Single | Twin |
| I. H. P. for 10 knots | 1,525 | 1,550 |
| I. H. P. for 11 knots | 2,125 | 2,100 |
| I. H. P. for 11½ knots | 2,500 | 2,402 |
| I. H. P. for 12 knots | ..... | 2,800 |
| Deadweight carried in tons. | 5,000 | 7,400 |

It will be noticed that the displacement of the larger vessel, the model of which was tried in the tank, is 46 per cent in excess of the smaller, and the power identical at cargo vessel speeds. The larger vessel

**E. H. RIGG.**

E. H. Rigg, the author of this paper, received his training as a naval architect at the city of London and West of Scotland technical colleges. He served for seven years in the ship yard and drawing offices of the Fairfield Ship Building Co., Glasgow. He was for eighteen months on the surveying staff of the British Corporation for Survey of Ships at Glasgow. Since 1901 he has been in the service of the New York Ship Building Co., Camden, N. J., having been appointed their naval architect in 1909.

*Paper read at Society of Naval and Architects and Marine Engineers, New York, Nov. 16, 1912.

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would take even less power at sea than the smaller on account of size. The first vessel is an oil tanker and the second a United States naval collier of the Mars class.

*Example No. 2*

An interesting case of extravagant design came up recently. A shipping firm had plans of an 11-knot steamer built in Europe of the following general dimensions:—400′ 0″ × 52′ 0″ × 34′ 0″. They wanted a duplicate built here, but with machinery for 10 knots only. The suggestion that the steel hull could be built 6 per cent cheaper to modified dimensions without affecting the coal bill was rather a shock to the prospective owners. The vessel as redesigned, with identical deadweight, draught and cargo capacity, worked out at 370′ 0″ × 54′ 6″ × 35′ 0″. The power worked out as follows:

| Item. | 400-ft. ship. | 370-ft. ship. |
|---|---|---|
| Skin E. H. P. | 685 | 645 |
| Residuary E. H. P. | 365 | 405 |
| Total | 1,050 | 1,050 |

These are for 10 knots in each case. In addition to less first cost, the shorter boat will be handier at sea, more easily taken care of as regards stability, and occupy less space at piers. There was no question of repeating an order.

*Example No. 3*

In heavy bulk carriers it is desirable to know how full a vessel can be made, keeping capacity down and so having no more ship than is necessary. A majority of ship designs on this coast are prepared for light cargoes occupying large space, where ship dimensions run large per ton deadweight; hence the saving in ship dimensions possible when carrying ore, for instance, is apt to be overlooked.

COMPARISON OF PROPERTIES.

| | A. | B. |
|---|---|---|
| BEAM AT WATERLINE. | 43'-0" | 45'-0" |
| DRAFT. | 12'-6" | 12'-6" |
| DISPL^T IN TONS | 2230 | 2260 |
| BLOCK COEFFICIENT | .541 | .524 |
| PRISMATIC " | .634 | .568 |
| MIDSHIP " | .853 | .922 |
| TRANS. K.M. (KEEL TO META:) | 18.30' | 18.38' |

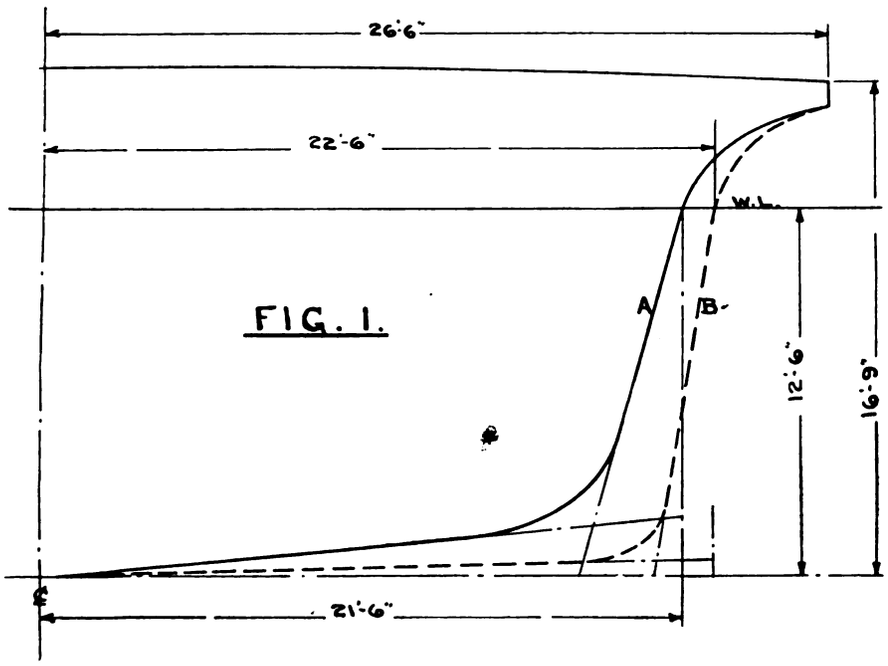


FIG. 1.

These vessels are frequently run at only 9 knots, even though they have some margin of power; the problem resolves itself into one of finding the range of dimensions where the total resistance remains constant, even though the component parts vary. In a design to carry 7,000 tons deadweight it was found practicable to increase block coefficient from 0.75 to 0.78 and reduce length from 360 to 340 ft. for the same effective horsepower at 9 knots; this represented a 5 per cent saving in steel hull. Beam and draught remained constant.

This problem and the preceding one are merely examples of searching for the economical limit of speed, on which subject a good deal has been published from time to time.

While the temptation to keep power down by fining the ship is a strong one, especially when owners expect a very low coal per diem rate, ship designers should never allow the dimensions to run up beyond what this somewhat elusive economical limit requires.

*Example No. 4*

Quadruple expansion machinery versus triple for long voyages.

The author recently had a very forcible example of the saving possible if quadruple expansion machinery were fitted in a cargo steamer designed to carry 7,000 tons of paying freight for a distance of 14,000 miles, oil burning. The figures came out as follows:

| Item. | Quadruple. Ft. | Triple. Ft. |
|---|---|---|
| Length | 400 | 410 |
| Breadth | 53 | 53 |
| Draught | 27 | 27 |
| | Tons. | Tons. |
| Ship. | 4,125 | 4,160 |
| Cargo | 7,000 | 7,000 |
| Oil, crew and water | 1,900 | 2,200 |
| Displacement | 13,025 | 13,360 |
| Speed, knots | 11 | 11 |
| I. H. P. | 2,750 | 2,800 |
| Savings per voyage | $2,500 | ..... |
| Extra first cost | $10,000 | ..... |

It will be seen that the extra first cost is recovered in four voyages, and after that a steady gain per voyage is apparent. This is not strictly an example of economy due to ship form, but has been inserted as being perhaps of interest.

*Example No. 5*

From the point of view of economy due to machinery, it can be shown that single-screw propulsion is cheaper than twin screw, the advantage of twin screw being in greater immunity from breakdown, a point by no means negligible in passenger and perishable cargo ships. This is well known to the members of the society and is only mentioned to make the examples more complete.

*Example No. 6*

Recently published photographs of our latest battleships in dry dock reveal a peculiar bulbous form of bow, the load water-line being narrowed and the displacement made up by filling out the lower water-lines. Experiments at the model tank in Washington show a material saving due to this form, the bow waves being naturally lessened by the fine upper water-lines.

The superintendent of one of our coastwise lines of steamers has had the courage to adopt this form of bow for a 12-knot cargo steamer, in which a 3 per cent saving would

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mean a ton of coal per diem, a by no means negligible amount when figured in dollars per annum. It is to be hoped this will be realized in service.

*Example No. 7*

It is well known that river steamers at certain speeds and in certain draughts of water create excessive waves, causing bad erosion of the banks, besides damage to shipping.

A firm of owners recently had conducted for them experiments with several models to see what could be done to reduce this wave under their operating conditions. The tank finally showed them the best lines on which to lay down the vessel for minimum wave-making, the speed being obtained with less power in addition. This also reduced the slowing up necessary to prevent damage to shipping along the banks. The top speed was obtained in deep, smooth water for less power with the model that gave best results in shoal water. The vessel is 410 feet long and of 8 feet draught.

In 20 feet of water a saving of some 5 per cent resulted at working speeds. At low and moderate speeds up to about 18 knots, the best model for shoal water was the worst in deep water, but this could well be ignored in a river steamer.

*Example No. 8*

A sound steamer of wide beam relative to draught, having flared guards. The plans submitted for bids had a midship section shaped as in *A*, Fig. 1; whilst this is good for stability, it seems to be capable of considerable improvement from the point of view of the coal pile. Recognizing the necessity of keeping the same stability, section *B* was designed. At the expense of a 2 per cent increase in the shell and framing of the vessel, an 18 per cent saving can be made in the coal bill; in other words the improved lines would cut the power from about 2,750 to 2,250, indicated, at 16 knots on a deep-water mile trial. The vessel was 270 feet long and of some 2,250 tons displacement.

Anyone who keeps up to date with the transactions of this and kindred societies will know what valuable original research work has been placed on record during the last few years. These notes make no claim to originality, but merely attempt to show, from the point of view of the practical designer of ships, the results presented in another form by our fellow designers working at experimental tanks and in colleges along more purely scientific lines than are possible at a ship yard, where the contract delivery date generally places a strict limit on the amount of preliminary investigation possible before the design has to take concrete form in the mold loft and the shops.

*Discussion on Mr. Rigg's Paper*

**Mason S. Chace:**—I am very much interested in what Mr. Rigg has stated, but I feel that the work done by the shipbuilder, the naval architect, and the engineer, is so closely associated and so overlapped that it is very hard for one of the trio to make any progress without either pushing or pulling the other one along. I am sure we all feel that the experimental data which we have gathered from the experimental model tanks has been of the greatest benefit. Today few designs are made without using such data in one form or another, and we can thank the Froudes for giving us the law of comparison in such practical form as to enable us to use it. The one point in connection with using the law of comparison which we must not forget is we must not press it too far. If you stretch a law too far, you will break it, and we do not stretch the law of comparison too far. We use large operative models, we are taking a step intermediate between the small model and the ship, which enables us to get more accurate data on which to base the performance of the ship than is obtained from the small model. When we use small models and split hairs over the results based on the performance, we are likely to fall into error. So, also, when we take the results of ship trials, unless they have been carefully conducted and are really comparable, we are likely to draw a too general conclusion from the results of the trial, and to assume that one ship is superior to another, when the probabilities are that the trial conditions under which these ships were run are not exactly comparable.

*Debt to Model Tanks*

I agree with what Mr. Rigg has said as to what the naval architects owe to model tanks. We in this country are particularly indebted to Naval Constructor Taylor of Washington and the authorities of the Washington Experimental Station. Any of us who have experimented there have, I am quite sure, met with uniform courtesy on the part of those gentlemen. Naval Constructor Taylor has presented, in the form of papers, before this Society many of the results which he has obtained in his tank tests, and he has also written a book on "The Propulsion of Ships", in which he has made an analysis of the results obtained from a number of tank tests on a large series of models, which would be far too expensive for any individual experimenter to conduct. By means of these results it is possible for those working within the limits of ratios of beam to depth, and longitudinal coefficients and displacement-length coefficients, which he has published to very closely approximate the residuary resistance of any ship for which we are working out these designs. Unfortunately, these series of contours of residuary resistance hardly embrace ships of all of the proportions which we, who are called upon to design, in the case of merchant vessels in particular, would like to have.

In fact, I think that comparatively few models are taken to Washington by shipbuilders as preliminary designs, and the results of the tank tests of these models compared with the results of the standard series from which the contours of residuary resistance given in Mr. Taylor's book were derived, without finding that improvements have been made in these models in order to obtain as good results as the standard series given. It is difficult to design models which will give better results than those obtained from this standard series. The principal danger to the shipbuilder using the results of the standard series in their work is that they may lead him to be too optimistic as to the power necessary to obtain the required speed.

Mr. Rigg referred to the test of the large operative models of the Mauretania and Lusitania, and it seems to me a large operative model is a step between the small models of 12, 15 or 20 ft. long, tested in the tank, and the full size ship, and certainly the Cunard people were repaid for the expense of building these operative models by the accuracy of the results they obtained.

Prof. Peabody has been making tests on the Charles river, where he has had the results of the data obtained in the model experimental basin, and also the results obtained from the trials of the ship to work from. The two models on which he experimented are from 30 to 40 ft. long, I believe, which enabled him to get some intermediate points between tank results and the results of the full sized ship, and it is important that he should get these intermediate points, as a test of the law of comparison and to use the law of comparison without stretching it too far.

*Displacement and Speed*

If we take Mr. Rigg's paper and look at Example No. 1, we see there two ships, one of which has a displacement 46 per cent in excess of the other, and we find that at a speed of 11.5 knots it takes the same power to drive these two ships. Of course, that is very striking—that you can drive with the same power 46 per cent more weight at the same speed. The question arises:

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Are these results given as the results of model tank tests, or are they the combined results of model tank tests and actual trials? If so, were the trials of these ships run under the same conditions—is the data, as far as it goes, strictly comparable, assuming that the results are absolutely correct, which I do assume? Although we have not the full data of these ships, if we look at the dimensions given, we find in the case of the oil tank ship, in the left hand column, under the heading "1903", that the ratio of length to beam is 7.78, and we find in the case of the ship in the right hand column under the heading "1909", that this ratio is 7.26. That is not much difference. We find the ratio of beam to draught for the left hand column ship is 2.245, and in the case of the right hand column ship 2.146; in other words, the ship described as the better ship has a slightly smaller ratio of beam to depth; in other words, she is deeper in proportion to her beam. At the speed of 11.5 knots, at which these ships take practically the same power, the speed-length ratio $V\!L$ in the case of oil tanker class is 0.606, and in the case of the navy collier class is 0.586; that is to say, the speed at which these two vessels are run in proportion to their lengths, are practically the same. The block coefficients of these two vessels are almost identical, the deadweight capacity in tons in percentage of the displacement working out at the same in both cases, about 65 per cent. The ship described as the poorer one, the oil tanker built in 1903, has a displacement-length coefficient, or coefficient of fatness, as it is sometimes called, of 165, and the other ship, which has proven superior, has a coefficient of fatness of 197; in other words, it is a fatter ship than the first vessel. If the author of this paper would present us with the curves of resistance, residuary and frictional, in the case of these two ships, also the trial trip data, we will see how it is possible to obtain this very remarkable economy which he has presented for our consideration. Such data will make the example which he has furnished complete.

*Maintenance of Speed*

Example No. 2 refers to two ships which require the same total horsepower to drive them at the given speed of 10 knots. If we go into the question of the skin E. H. P. and residuary E. H. P., we find that in the case of the 370-ft. ship, the residuary resistance is more than 40 per cent of the total resistance, while the percentage of residuary resistance in the case of the 400-ft. ship is comparatively less. The question arises in this example as to the maintenance of this speed of 10 knots. In a ship of this class, where we are interested in the maintenance of this speed of 10 knots at sea, the question arises as to whether this 370-ft. ship with a larger residuary resistance in per cent of the total resistance than the 400-ft. ship, will maintain her sea speed as easily as the 400-ft. ship. I think the experience of everybody has been that in order to obtain a certain speed at sea, we have to build the ship for more speed in the smooth water trials, and that as a general proposition if we take two 10-knot ships, one of which will drive at 10.5 or 11 knots in smooth water easier than the other will at this increased speed, we will find that it will be easier to maintain 10 knots with that ship in sea service than with the other ship whose power curve runs up more quickly above 10 knots and requires a 10.5 or 11 knots more power than the first ship. Has Mr. Rigg drawn his conclusion in example No. 2 entirely from the results of model tank tests? It will be interesting for us to have the results of these tests and the trials of the three vessels.

*Gain in Residuary Resistance*

We pass on to example No. 6—we are all much interested in the gain in residuary resistance which can be obtained at certain speeds—length, ratios with vessels of different types by finding the load-waterline and lengthen out the lower waterlines, as is done particularly is the case of our large battleships. There is a question in the minds of many as to whether or not the same economy in residuary resistance will be realized in sea service by this method in the case of ships of the merchant vessel type when driven at sea in rough weather.

When we come to example No. 7, speaking of river steamers, we have comparatively little data on river steamers, which has been published. We know in certain depths of water that ships may be propelled at high speed with less power than they would require in deep water, or, stating it in another way, that some ships when they run over shallow water courses exceed the speeds made in deep water; but, generally, when we try to run ships in shallow water, more power is required.

I think we know that, generally speaking, if we wish to design a ship for shallow water we must make such a ship as will in deep water, at a higher speed than its designed speed in shallow water, have a comparatively moderate wave-making resistance; in other word, of two models which run at the same speed in deep water, if we run these two models in shallow water, the ship which at some increased speed would show less resistance, relatively to the other one, in deep water, would probably beat the other one in shallow water. I think that point has been made before.

In the last example, cited by the author of this paper, it seems to me the reason for the gain is very apparent. We find there that the prismatic or longitudinal coefficient in the case of the boat in column *A* is 0.634, and in the case of the boat in column *B* is 0.568; in other words, the longitudinal or prismatic coefficient has been reduced by increasing the area of the midship section and fining the ends of the vessel.

*Reduction of Longitudinal Coefficient*

If we study the curves of residuary resistance given in Mr. Taylor's work, we will find why we could expect to find in the case of the two vessels cited in this last example an economy in residuary resistance obtained by the reduction in the longitudinal coefficient of as much as from 40 to 50 per cent. We can consequently expect some increase in skin resistance and still materially gain by the change in dimension and proportions of the ships made.

One of the main points brought out by modern model tank tests is the fact that with ships running at certain speeds in proportion to their lengths we may judiciously increase the area of the midship section and fine ends of the vessels, that is, decrease the longitudinal coefficient.

**E. H. Rigg:**—I would like, however, to say a few words as to Mr. Chace's remarks on the first model. I described the great gain due to the experimental tank and propeller wheels, and in the last example, No. 8, where he says that the ratio is undoubtedly due to fining the prismatic coefficient, I wish to say that that is exactly what it is. The naval architect must tell the owner of these things, or he will not get onto them.

**George Simpson:**—This is a very interesting paper, but I think that Mr. Rigg is a little bit on the wrong track. I do not like to say that, because he is a personal friend of mine. I think that all this talk about the prismatic coefficient is absolutely wrong as applied to a freight carrier. It is all right when we are dealing with high-speed ships.

When we deal with cargo carrying vessels, in which we must have a certain amount of midship area, we all make the boat as fat as possible; we do not do it to save 3 per cent in horsepower, because every engineer knows that you can more than eat that up in a slack season.

*Length the Important Factor*

Why do we fill it out? The thing is to get the boat as short as possible to carry the deadweight, because every one connected with ships knows that length is the important factor in the ship, and that is the expensive factor. Beam does not cost one-tenth of what length does.

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As to these ships Mr. Rigg refers to, I happen to be the designer of the ships, one of them he calls the Mars class. It is not the Mars class, it is the Everett - Malden - Melrose class, the pioneer of the present colliers in this country. I fixed these proportions and can say something about them. In fixing these proportions I aimed to shorten the ship. If I were designing the ship today, I would shorten it much more. If it is of interest enough to put in this discussion—I have not the data with me—I will prepare a table giving one of the last competitive designs in a cargo boat that has been brought out in this country. That design was contemporaneous with the Mars class Mr. Rigg refers to. A number of large shipbuilders went into that competition. The owners gave complete specifications as to what they desired in the ship, but left out everything in the way of dimensions. They said: We want a vessel to carry so many hundred tons deadweight on a certain draught, the ship to go to certain speed. Everything else was blank. The beam was stated as so and so, and they gave their reason for that. The design that won out was 25 ft. shorter than the longest one, and I can also tell Mr. Rigg that the firm with which he is connected were just about 15 ft. longer than the winning-out one. That all comes back to this:—That in a cargo boat the prismatic coefficient does not amount to anything, because we all of us would make the boat a box amidships if it were possible. You have got to have so much dead flat length when you come to the end, what can you do? You probably have one-sixteenth of the length that must be fined. A hundred designs could not vary much in the general arrangement, and we come back to the engineering again. If one boat does better than the other, it is due, in all probability, to a better design of the propelling end of the vessel. We can appreciate that, whether we are experts of the propelling end or not. In my opinion, to give examples of freight boats, and to bring in the prismatic coefficient, is tommyrot. It may be all right in the case of a battleship. Let me show you where it comes in in the case of a battleship. I do not think I am giving away any state secrets in mentioning the Rivadavia and Moreno. A certain firm took those boats. The speed-length-ratio jumped up at the last minute. They wanted more speed. D. W. Taylor saw where they could get it, by putting 3 ft. on the beam of the boat. When he put in his prismatic coefficient, he fined off the end of the boats, and if these boats are a success, it is due to D. W. Taylor.

**Thomas M. Cornbrooks:** — In connection with the example on page 3, regarding Mars class, I desire to make a correction in the statement made by Mr. Rigg. I note Mr. Rigg gives the credit for the performance of this vessel to the experimental model basin, while Mr. Simpson claims the credit for himself; neither statement is correct. In the first place, the keel of this vessel was laid in October, 1908, the model was tried in the basin in March, 1909; consequently the trial had no influence on the lines.

*The Mars Class*

Mr. Simpson states that the Mars class is a copy of the Everett. While the outboard appearance of these vessels is similar to the Everett, I cannot see how the appearance would affect the economy. The lines for these vessels were designed by the company with which I am connected and the credit for the performance belongs to them.

It is evident that Mr. Rigg is a great believer in the experimental model basin, and it is to be regretted that he did not secure more reliable data in regard to some of the examples which he presents.

On page 6, Mr. Rigg speaks of a Sound steamer, which has recently been designed, and makes a very broad statement in reference to I. H. P. and saving in coal bills. I would like to ask Mr. Rigg whether his conclusions are based on model experiment or on theory. The difference in I. H. P. shown is 500. Figuring from Mr. Taylor's curves the E. H. P. for each vessel works out as follows:

| "A" | "B" | |
|---|---|---|
| 831 | 837 | Frictional. |
| 666 | 654 | Residuary. |
| 1,497 | 1,491 | Total E. H. P. |

at 50 per cent eff. equals "A"—2,994 and "B"—2,982 I. H. P., or a difference of 12 I. H. P.

Constructor Taylor says in regard to "The Influence of Midship Section Shape Upon the Resistance of Ships":

"The shape of the midship section has a comparatively minor influence upon the speed, and that the midship section coefficient may range from 0.85 to 1, with very little effect on speed, and may be made as low as 0.70 without a material increase in resistance.

"Also increased beam means increased disturbance of at least a portion of the water which a ship passes."

In view of the foregoing, it is difficult to see where Mr. Rigg secures a saving of 18 per cent in the coal bill.

**E. H. Rigg:**—Possibly I have given the tank too much credit, and I am glad to be corrected.

Referring to Mr. Simpson's remarks, I think if he will study my examples Nos. 2 and 3, he will find that to shorten the ship is what I did. The prismatic coefficient was only discussed in the case of a very fine Sound steamer, not in connection with a cargo steamer by any means. The whole point in examples Nos. 2 and 3 was to show the economy to be gained by a certain amount of shortening. There was no question of prismatic coefficient in those examples. The prismatic coefficient came in on the last example.

## Twin-Screw Power Yacht

J. Murray Watts, naval architect, of Philadelphia, has designed for a western yachtsman a twin-screw motor yacht 100 ft. over all, 85 ft. water line, 15 ft. beam, propelled by two 150-H.P. motors. The motors are of the semi-Diesel type burning distillate. Owing to the heavy construction of the steel hull and the weight of the engines, no extreme speed is expected, but at 350 R. P. M. the motors will drive her at an average of 14 miles.

In general appearance the boat shows the fast Vidette type with two stacks and a small conning tower forward used as a pilot house when cold weather makes the steering position on the bridge uncomfortable. Head room is obtained in this conning tower by means of a sunken well which comes just over the four poster bed in the owner's stateroom below.

This stateroom is a feature of the design, being of unusually large size, 12½ ft. long by nearly 14 ft. wide. There is a toilet room adjoining the stateroom and plenty of room for lockers, sofa, bureau and wardrobes.

The guests' quarters on this boat are aft and consist of a large double stateroom with the bathroom adjoining. The dining saloon is a room 12 ft. by 14 ft. communicating with the bath room on one side and the galley on the other. A Franklin stove, set off by a handsome mantlepiece will keep these quarters warm in winter cruising.

The engine room is amidships about 12 ft. long by 15 ft. beam, and in it are installed the fuel tanks, the lubricating oil tanks, the auxiliary lighting and pumping machinery and a large work bench.

The crew's quarters are favored and consist of a state room and private dressing and toilet room for the officers. Aft of this comes the forecastle for the crew with accommodations for four men and a separate toilet.

The finish in the crew's quarters and engine room and galley will be in white paint; a special form of ground cork being used on the steel bulkheads, and frames and side plating. The owner's quarters and guests' quarters will be finished in mahogany except the bathrooms which will be in tile and white enamel. The conning tower which will also be used as a smoking room will be finished in teak, as will be the rest of the deck houses.

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# Highly Interesting Comparisons

## *Some Valuable Data on the Operation of the Erie Railroad Transit Lines Fleet*

THE management of the Erie Railroad Transit Line (the lake arm of the Erie Railroad), has generously contributed additional data on the operation of its fleet based on the past season's completed figures.

These figures, which should be read in connection with those printed in THE MARINE REVIEW for January and July, 1912, permit the drawing of a highly interesting comparison extending over three years, and emphasize the thorough-going character of the work which has been done.

It will be noted from Table I that there were seven ships in operation during 1912 but that owing to the freight handlers' strike in midsummer and subsequently to delays due to scarcity of cars to move cargoes, the total trips were only three more than in 1911. The port delays due to these causes are reflected in the average hours on trip, which increased from 314 to 383, or nearly three days. In spite of the extra ship and the three additional trips the total coal shows a substantial reduction, the reason for which is easily seen upon referring to Table II.

Coal per mile figures are not given for the reason that their derivation is open to considerable doubt. Unless actually weighed, port coal must be based upon bunker estimate and the per-mile coal obtained by dividing the remainder by miles run and these estimates have been found to vary widely even in the same ship. The coal per trip is, however, considerably more accurate than usual in such tabulations, since the line ships and handles its own coal entirely and weights are checked carefully. As evidence of this it is stated that the entire season's fueling operations checked within 14 tons of billed weights.

TABLE I—GENERAL RESULTS

| | 1910. | 1911. | 1912. |
|---|---|---|---|
| Ships in commission. | 8 | 6 | 7 |
| Total trips..... | 105 | 93 | 96 |
| Average hours on trip | 351 | 302 | 314* |
| | | (second half) | 383 |
| Coal, total tons..... | 25,692 | 18,172 | 17,488 |
| Coal, per trip average | 244 | 195 | 179 |
| Reduction, per cent.. | ... | 20.1 | 8.2 |
| Speed, miles per hr., average ..... | 10.65 | 11.46 | 11.25 |

*First half.

An effort has been made to reduce the average speed to 11 miles per hour and establish propeller constants for varying trims and work in this direction is still in progress. While the fleet average is still well above the 11-mile objective, it is chiefly owing to advances by ships E and H, the former increasing 7 per cent and the latter 3 per cent over 1911. When these increases are flattened out the fuel reduction of these ships will be still more noticeable.

TABLE II—CONDENSED COMPARATIVE FUEL STATEMENT

| | 1910. | 1911. | 1912. | Overall reduction, per cent. |
|---|---|---|---|---|
| A | 247 | 226.5 | 215 | 13.0 |
| B | 249.9 | * | 235.6 | 6.0 |
| C | 202.2 | 191 | 143.8 | 29.0 |
| D | 206.8 | 153.4 | 146.8 | 29.0 |
| E | 258 | 230 | 179 | 39.0 |
| F | Not in commission 1911-12. | | | |
| G | 285 | 166.4 | 163 | 43.0 |
| H | 218 | 198.6 | 171.25 | 22.0 |

*Only made two trips in 1911.

It will be noted that in July the fuel performance of E was given at 165 tons but owing to the increase in port time in the latter half of the season (in her case from 147 to 258 hours per trip) and to increased speed, this rate was increased as shown in Table II.

The improvement in C and H is due to changes in engines entirely since no alterations whatever were made in boiler plant. In both cases, however, the boiler equipment will be modified this winter and further improvement is anticipated as a consequence.

Ships A and B have not hitherto received any special attention other than as to details of operation but, as a result of observation of the other ships of the fleet, will this winter receive extensive alterations and if these prove as successful as anticipated the over-all reduction of the fleet will be materially improved. The various steps taken have been the subject of careful observation and have resulted in the accumulation of a large amount of data of an unusual character.

One of the minor features of operation as to cost is that of lubrication but nevertheless the following comparative statement is of interest. The costs include all lubricants charged to the ships and are stated in cents per hour based on hours running. The figures show the average for the fleet.

| 1910. | 1911. | 1912. | Overall reduction, per cent. |
|---|---|---|---|
| 9.05 | 6.44 | 4.94 | 46.0 |

Observation has not so far developed that the minimum has been reached in any instance but on account of the relatively small amount involved and the necessity for extreme caution in this particular, progress is necessarily slow.

Accurate information of the character noted in this and previous statements referred to above is extremely difficult of access, and its willingness to supply it emphasizes the progressive character of the railroad executive.

It is certain that further data will be looked for with interest.

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## Repairs to Transport Dix

When the United States Army transport Dix returns from her next voyage to the Orient she probably will undergo extensive alterations. Approximately $170,000 will be spent on her, if plans of the quartermaster's department are carried out. The Dix was all but condemned as unseaworthy by the inspector-general when she arrived at Manila on her last voyage across the Pacific, and a long report, giving in detail the condition of the transport, has been forwarded to Washington. The vessel's galley has been condemned as unsanitary, her hospital ward as too small, her decks as unsafe and her crew's quarters as cramped and badly ventilated. It is proposed to extend the steel decks fore and aft, construct an entirely new house, and provide better and larger quarters for the crew, a new galley and a new hospital ward. The plans practically call for the rebuilding of the interior of the transport, the construction of a new house and extensive steel deck work. There is an appropriation of $170,000 which can be drawn upon for the alterations, and it is believed that bids will be requested within a few weeks.

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# THE MARINE REVIEW

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January, 1913

## *Satisfactory Lake Season*

The lake season of 1912 has been one of the best on record, even though the vessel owners made but little money. The volume of freight moved was the greatest in the history of the trade, and what is best of all, the season ended with great firmness and with a rising market. No season ever closed with better prospects for its successor. A great impetus was given to the business in the early spring by the announcement of the iron mining companies that ore would be sold at from 65 to 75 cents a ton less than the prices ruling during 1911, and therein began the greatest revival of industry that the iron trade has ever known.

The ore movement started in May and kept up a 7,000,000-ton clip until October, inclusive. There did not seem to be ships enough to do the business. Everyone was in the market for tonnage and several vessels that had been lying in ordinary for years and that it was supposed had passed their period of usefulness, were fitted out and rushed into commission, presenting a scene as unlike that which existed two years ago as could possibly be imagined.

The ore rate was cut 5 cents at the beginning of the season and experience proved that even the modern class of carrier had difficulty in breaking even at that figure. In fact, none of the vessels would have made any money had it not been for the extremely satisfactory rates paid in other trades. The harvest, for instance, was abundant and the grain movement was almost double that of any preceding year with the result that grain shippers had to pay good rates to move the commodity. A vessel made as much on one cargo of grain as she did on two cargoes of ore, and sometimes even three cargoes of ore. This situation helped materially in putting the balance on the right side of the ledger. The leading independent companies, however, paid very moderate dividends, ranging from 6 to 7 per cent, and in one case 10 per cent. Some of the smaller independent companies, which have no trade connections, were unable to earn a dividend.

The demand for ore was constant throughout the year and appeared even to be growing in the fall months. Even in October furnace interests were eager to cover their ore requirements for 1913. The iron ore companies were equally eager to delay matters until the business of 1912 could be closed, but the issue was forced and prices were established upon a basis of from 55 to 65 cents a ton higher than 1912 prices, or just 10 cents lower than the 1911 rate. The rail rate from the mines to upper lake docks, however, was 20 cents less during 1912 than 1911, so that in effect the producing companies are getting the 1911 rate.

The effect of this announcement was surprising. Within a day 5,000,000 tons of ore were sold upon that basis and within a week, counting the tonnage controlled by shippers, a movement of 45,000,000 tons during 1913 had been covered. The business of the new year was lined up before the old year closed, a situation which certainly has not existed hitherto. It is now expected that the iron ore movement of 1913 will reach 50,000,000 tons.

## *Activity in Ship Building*

An examination of the ship building returns published in the present issue will show that the ship yards of the United States have an excellent program of new construction on hand. While the ship yards of the great lakes have only a few bulk freighters under order, which in normal years constitutes the major part of their construction, they have quite a variety of other craft and are reasonably busy. The ship yards of the United States may from now on expect a fair amount of construction for service through the Panama canal. How great this will be remains to be seen, but the trade must inevitably be a steadily growing one.

It is in Great Britain, however, where the most wonderful activity exists in new ship construction at the present time. The ship yards of Great Britain are building 505 merchant vessels of 1,846,830 tons gross and 82 war ships aggregating 494,540 tons. These figures would be quite largely added to were it possible for ship yards to promise early delivery, but this they cannot do, owing to their inability to get material from the mills or to the fact that their berths are already filled. There is, therefore, a great deal of buying going on at present of partially completed ships, that is to say, ship owners in their eager-

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ness to get tonnage promptly are willing to pay a stiff advance over the contract price for vessels already under way, the object being to take quick advantage of the excellent freight rates now prevailing in all parts of the world.

The work under construction embraces liners, tramp steamers and oil tankers, of which latter variety an unusual number are building. The prices paid are certainly very high, being as high as $60 a ton for coasters and colliers. The high prices, however, do not appear to act as a deterrent upon new orders.

## The Supervising Inspector General

George Uhler, supervising inspector general of the Steamboat Inspection Service, has occupied that highly important office with credit to himself, to the service and to the country for the past decade. With the exception of the local inspectors, the offices embraced in this department are not under civil service rules, with the result that the impending change in the national administration has brought out a number of applicants for Mr. Uhler's position. It would be a very great mistake if a change should be made in this office. With the exception of one supervising inspector, Mr. Uhler is the only practical engineer on the board. He has filled the office with intelligence, with patience and with fairness. He has given everyone an audience and he has always ruled according to the merits of the case. Engineers who have visited Washington have always found him accessible and sympathetic and his great knowledge of engineering has always been a source of satisfaction to them. It would be difficult to replace Mr. Uhler in this position and the hope that no attempt will be made to displace him will be shared by marine interests generally.

## Pure Water

One of the sanest movements of the day is that undertaken by the Niagara Frontier Pure Water Conference, which is endeavoring to safeguard the health of the nation by insuring a supply of pure water at one of the country's crucial points. During 1912 over 17,000,000 passengers were carried on the various steamers on the great lakes and there is no point on the continent more attractive than the Niagara river with its wonderful falls and rapids. Undoubtedly, in the course of the year some person from every section of the country at least, if not from every part of the world, visits this great natural spectacle.

The whole world is stirred when a great ship like the Titanic founders with its burden of human freight. We are appalled when some convulsion of nature such as Messina wipes out thousands of lives in a twinkling; but we are entirely oblivious to a devastation equally as great and infinitely more cruel that is going on under our eyes from day to day. The death toll of the rivers has been going on for ages. The ceremony of human sacrifice as performed by the tenets of ancient Hinduism and especially the tossing of little children into the River Ganges supposedly to concilliate the deity, fill us with horror, but we are unmindful that a greater toll is exacted from day to day from our own rivers. The case of the city of Niagara Falls well exemplifies the point of this. All the waters of the great lakes pass that point and the ravages of typhoid fever caused by sewage pollution at Niagara Falls were the highest of any city, the rate reaching a maximum of 184 per 100,000 population. More than this, there is no telling how many tourists left the place with the germs of the disease in their bodies.

The work of the Niagara Frontier Pure Water Conference is, therefore, one of the highest wisdom. Since the filtration plant was established at Niagara Falls, a substantial reduction has been made in the death rate. The campaign should be continued until every city on the lakes is assured of an absolute pure water supply.

## Wilson Seamen's Bill

As though there were not enough worries in the ordinary course of the day's work, the Seamen's Union is endeavoring to create a few. There is now before the senate a bill known as the Wilson Seamen's Bill, which, if passed, will increase the crews of merchant vessels by one-third. The measure is a general one and is applicable alike to deep sea and inland waters. Its provisions are perfectly absurd when applied to the lake fleet. In fact, if it should pass it would be necessary to erect additional deck houses on the bulk freighters to accommodate the added members of the crew. Everyone at all familiar with lake trade knows that the crews of lake freighters are at present quite ample for the work which they have to do. Moreover they are extremely well paid for their work and in creature comforts are extremely well cared for. Their quarters are well ventilated and toilet accommodations include both tub and shower baths.

Yet to read the testimony as submitted by the representatives of the Seamen's Union before the senate committee one would imagine that they were the most abused lot in the world. Evidently, the representatives of the unions will not stop at anything but will say whatever comes into their heads. They did all that they could to mislead the members of the senate committee, and it is a pity that the time of the members should have been taken up in listening to such twaddle. There is no place in the world in which labor is better cared for than on the bulk freighters on the great lakes. The Wilson bill should either be defeated or its provisions greatly modified.

The index of THE MARINE REVIEW for 1912 is now ready and will be mailed to all subscribers upon request. It will be mailed without further notice to all subscribers who have requested it in former years.

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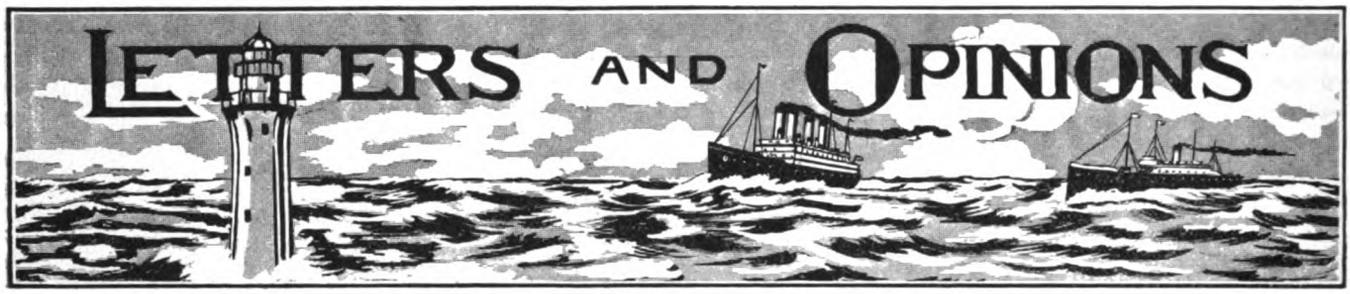


## Diesel Electric Canaler Tynemount

Editor MARINE REVIEW: Sir:—In various articles which have recently been published in THE MARINE REVIEW, in which reference has been made to the Diesel-electric propelled canal vessel Tynemount, less than justice has been done to our share in the design of this vessel and it occurs to us that it might be of interest to your readers if we place on record the process of evolution in the Canadian canal type which underlies the building of the Tynemount and in which we can certainly lay claim to have taken a leading part. Any interested reader of your columns knows what has been done by us in recent years to improve the deadweight and increase the all-round efficiency of the Canadian canal type. Absolutely held to fixed hull dimensions by the canal locks, we have yet been able, by careful adjustment of hull scantlings and improvement of the propelling machinery, to add 15 per cent to the greatest deadweight thought feasible a few years ago and to reduce the fuel consumed in this class of vessel from about 10 tons average per day throughout the season of navigation to between six or seven. Five or six years ago our attention was directed in this connection to the possibilities of the internal combustion engine, offering great reduction in engine weight, considerable saving of valuable hold space, and economy in fuel, cost and weight. Careful investigation of the existing types proved, however, that no direct drive by internal combustion engines, gas or oil, could offer any hope of reasonable propulsive efficiency or reliability.

*Influence of Local Conditions*

Theorists on this subject are too apt to neglect the influence of local conditions and nowhere are these conditions more likely to make their influence felt than in the Canadian canal trade. So important are these peculiar local conditions and so great is their influence on the propulsion of the Canadian canal vessel that it is no exaggeration to say that in designing a propeller for that type, the least important consideration is to get the best go-ahead speed out of the vessel. More care is devoted to getting a good maneuvering wheel, one that will get the vessel quickly into—and even more important—quickly out of a lock, and that will control and handle the vessel at all speeds in the canal system with facility and certainty.

Everyone familiar with this canal trade, and trade on the lakes generally, knows what is meant by the term "a lake wheel," and knows what happens when any other type of propeller is experimented with. In an ordinary steamer type of Canadian canaler with dimensions, say, 250 ft. by 42 ft. 6 in. by 14 ft. draught, coefficient say, 0.83 or over, and 700 I. H. P., the normal propeller would be 12 ft. diameter by 12 ft. pitch with large blade area and square blade tips. Revolutions not exceeding 80 per minute. Such a propeller could not be swung by any internal combustion engine of 700 H. P. yet invented.

*Electric Transmission*

At the time we first approached this subject, the Diesel engine available for marine use was in small units, 200 H. P. and thereby. Larger sizes were under construction but could not be relied upon for commercial purposes. It occurred to us that by using an electric transmission system we could divide the total propelling power into handy units by cutting out one or other of the units, relate the power generated to the exact requirements of the vessel at any given moment and materially improve the consumption conditions in that way. We realized that it was always important in oil engine work to have regard to the necessity for the lowest possible consumption if any saving were to be effected over the corresponding steamer's bill for coal, which can be obtained at a very low rate all over the lakes.

This subdivision of the power into sub-units was particularly attractive in canal work because in the canals the speed is limited to four miles requiring less than 200 H. P.; in the lake and river reaches 400 H. P. is quite sufficient; while in open water and against the river currents 600 H. P. is necessary. Therefore, our first designs show three units of 200 H. P. each, all furnishing current to a single screw of the ordinary lake type and turning at 80 revolutions per minute.

It must be evident that by the introduction of the third element, electrical transmission, it is possible to leave the Diesel engine in its most efficient high speed four-cycle form and yet to retain all the undoubted advantages of the single slow speed full bladed steamer wheel. On the other hand, to avoid the introduction of transmission of any kind, much time and ingenuity have been unhappily devoted to altering the propeller to suit the new motor and the new motor to suit the old propeller with the usual result—a compromise unsatisfactory to all concerned. Furthermore, no such compromise, however successful, could get over the serious drawback of having to reverse the main engines, a perfectly impossible proposition when it is understood that in traversing the St. Lawrence and Welland canal systems over forty locks, often close together in series, have to be negotiated.

*Works like a Charm*

Everyone knows that the reversing gear as now fitted on the Diesel engine works like a charm with compressed air behind it; but to back and fill with the best of Diesel marine engines a couple of hundred times in a few hours, it is necessary either to run the engine with compressed air, a very expensive game, or to ruin the engine and gear in very short order. There is no escaping from the conclusion that a transmission system of some kind is necessary to reconcile the conflicting revolutions of the new engine and the old propeller and to relieve the engine of the complications and troubles incidental to rapidly alternating, reversing, stopping,

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and starting, in negotiating the canal locks and reaches.

In the electric work we had the enthusiastic co-operation of H. A. Mavor, of Glasgow, whose pioneer work in the adoption of electric equipment to marine purposes ranks in the United Kingdom with that of Mr. Emmet in the United States. Mr. Mavor realized the scope which the peculiar conditions in Canadian canal work offered to the introduction of his system and made several inspection trips with us to Canada to investigate the situation for himself on the spot. Our first completed proposal was a Canadian canal type of oil carrier for the Standard Oil Co. This was to have three Diesel generating units of 250 H. P. each with a single screw motor turning at 80 revolutions. Though approved of by the engineers of the Standard Oil Co. and ordered to be built, the prejudices of their English advisers were sufficient to condemn the project and a steamer of the same type, the Iacomo, was built instead. Nothing daunted, Mr. Mavor and ourselves, with other associates, formed the Electric Marine Propulsion Co., Ltd., of Glasgow, to try out the Mavor system on a large scale. It was agreed that the Canadian lake type offered the best means for this purpose and the Tynemount was ordered from Messrs. Swan & Hunter, whose chairman, G. B. Hunter, had evinced great interest in these developments. The hull was designed to be closely similar to a steamer, the Keystorm, which was built two years ago to my designs and specifications, the intention being to arrange an accurate comparison between her and the new vessel. Subsequently, the Tynemount was sold to the Montreal Transportation Co. on my representations, and is now building under the supervision of my firm. We naturally claim to have been the moving spirits in this new departure in Canadian lake and canal work while acknowledging the active interest and co-operation of the builders of the hull and the machinery.

JOHN REID.

New York, Dec. 18.

## Diesel Engined Ship Eavestone

Editor MARINE REVIEW, Sir: — The Diesel-engined ship Eavestone after having made the initial trip to Sweden and Russia, followed with a trip from West Hartlepool to Barcelona, then taking on a cargo of ore at Pomeron for Savannah, Ga., has recently arrived at the latter port, her passage working out as follows:

Pomeron to Savannah, Ga., 3,701 knots.
Cruising time.18 days, 18 hrs., 14 min.
Average speed .....8.2 knots.
Average daily fuel consumption ..... 3 tons 18 cwt.
Oil consumed for the entire passage .....37 tons 10 cwt.

This is the first two-cycle Diesel-engined ship to cross the Atlantic ocean. The trip was made without a stop or difficulty with the machinery in any way whatever. Most of the passage was during very severe gales in which the characteristics of the marine Diesel engine were particularly brought out in its perfect control of speed, eliminating any tendency to race.

When it is taken into consideration that this Diesel-engined ship could take into her double bottoms enough oil as fuel cargo to make a trip around the world without necessitating a stop for new supply of fuel, one of the great advantageous features of the Diesel engine is brought out thereby.

This means a great advent in the shipping world, for now those who have stood back and waited to see someone else make the trial of Diesel ships in actual service, can be shown that it is practical and successful.

W. R. HAYNIE.

New York, Dec. 30.

## The Sperry Gyroscope

Editor MARINE REVIEW, Sir:—In the proceedings of the Society of Naval Architects and Naval Engineers, at their recent meeting, a paper was read by Mr. Sperry on the gyroscope for marine purposes. The writer has been interested in this device for some time and has devoted considerable effort as well as time to get this matter before the public. A vessel fitted with the gyroscope will be immune from most ills that ships are heir to. That is they will be stabilized in a manner to prevent any and all rolling motion, which feature is desired for all classes of vessels, but on none more so than on car-ferries.

Lastly, but not by any means least, a ship can be made to roll any angle desired. This feature is particularly desirable for vessels engaged in winter navigation as the vessel cannot become stuck in any kind of ice. The motion imparted by the gyro is the motion most desired, namely the to and fro motion applied to a brad awl, this motion being pendulic conforming to the ship's natural period of rolling.

The general adoption of this apparatus will make the lakes as navigable in winter as at any other time of year. It will mean much for the river and gulf of St. Lawrence, for the Baltic and other waters where ice is an obstacle.

B. T. HAAGENSON.

Ashtabula, Dec. 6.

## Reversible Oil Engine

Editor MARINE REVIEW, Sir: — The accompanying photograph represents a new development in the internal combustion engine for tug boats as well as good size freight or passenger boats. The picture was taken from a tug boat 53 ft. long by 12 ft. 6 in. beam by about 5 ft. 6 in. depth, equipped with a four-cylinder Mietz & Weiss reversible oil engine. This engine is well known throughout the world as one of the leading internal combustion engines, and the first in the field using heavy oils.

The marine line was developed some

TUG EQUIPPED WITH MEITZ OIL ENGINE

years ago when the stationary engines of this type had already been sold in large quantities. This is a two-cycle engine in which the preliminary air compression for scavenging takes place in the crank case, which is the simplest method in use, and the builders have put out units of 200 H. P. in cylinders of 14 x 18½ and units of 100 H. P. single-cylinder engines of 18 x 27 at a speed of 180 r. p. m.

It is well known that the reversing gear which has brought about the application of the small internal combustion engines to thousands of boats, is not suitable for the large sizes because the output of the engine increases at the square of the diameter of the pistons, while the requirements for the clutch go up in direct ratio of the horsepower, which means that we do not have to go up very high in horsepower before the clutch becomes higher than the engine. But, apart from this there is naturally a tendency, and particularly for marine work, to simplify the mechanism to increase its reliability. The two-cycle engine is particularly desirable with

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its impulse every turn for marine engine. It reduces the weight and is productive of almost constant torque at the propeller shaft.

The special feature of the reversing mechanism in this engine has hitherto been published and all that is necessary now is to refer to it in a general way.

For certain reasons that are to be considered on a two-cycle engine, the controlling lever which admits the air to the distributer must of its first movement cut out the oil injections so that the minute air of higher atmosphere is admitted to the cylinders, there is no charge formed which might then bring about an abnormal pressure. The mechanism is, therefore, arranged so that the oil injections are positively locked at the first move of the lever for either direction of rotation. A further movement of the lever admits air in whatever direction of rotation the engine is supposed to run, and not until the engine is in motion will the oil injections take their regular course from the pump which is controlled by the governor to the cylinders in their various sequence.

The distributing valve is nothing but a rotating valve driven by the shaft of the engine with ducts cut in the casing to admit the air to the three or four cylinders, whatever the engine might be in the proper order of its rotation. The controlling lever which is attached to an ordinary two-way cock admits the air, either for forward or reverse, or in its central position shuts it off entirely. There is no other mechanism necessary, and inasmuch as the engine shaft is directly coupled to the propeller shaft there is no fly-wheel required, and as a matter of fact the engine in its outward appearance resembles a steam engine rather than the ordinary combustion engine with its clutch and fly-wheel.

One feature of this engine should be mentioned and that is the speed reduction that can be had by the throttling lever. By the throttling lever which acts on the injection pump and which in this case brings it down to about 80 to 100 r. p. m., at which the engine can be going constantly, just barely to move the boat, while the maximum speed at full force is 340 r. p. m.

Engines as high as 400 h. p. are at the present time put out by the builders under certain rigid guarantees as to oil consumption, manipulation and general performance. We believe that this type of engine has proved a great step forward in the right direction for marine oil engine propulsion.

Yours very truly,
AUGUST MIETZ.

New York, Dec. 6.

## Example and Answer

Editor MARINE REVIEW, Sir:—Please work out the following example for me:

With a safety valve 3 in. in diameter, with 140 lbs. steam pressure; length of lever, 36 in.; distance from center of valve to fulcrum, 3½ in.; actual weight of lever, 18 lbs.; actual weight of valve and stem, 6 lbs.; center of gravity of lever at half length of lever from fulcrum; what weight would be required at the end of the lever?

The example works out as follows:

Diameter of valve 3 in., area 7.06 sq. in.

Load on valve = $7.06 \times 140 = 989$ lbs.

Effective weight of lever at mid-length (18 in.) = $\frac{18 \text{ in.}}{3.5} \times 18 \text{ lbs.} =$ 92.5 lbs.

Therefore, net load on valve is equal to 989 lbs. less effective weight of valve and lever, or 889.5 lbs.

Ratio of short end of lever to total length = $\frac{36}{3.5} = 10.286.$

Hence, 889.5 lbs. divided by 10.286 gives weight to be placed on end of lever or 86.5 lbs.

## The Toiler's Mishap

The oil engine boat Toiler met with an accident early in the fall while maneuvering in the locks below Kingston, Can., one of her cylinders on the starboard engine breaking at the housing near the bed-plate from some cause not yet explained. The steamer lay about three weeks at Montreal while repairs were made on the broken engine. Considerable difficulty, however, was experienced in getting the engine to run again because of disarrangement of fuel and air valves and setting of same.

After many unsuccessful attempts the owners cabled Swan & Hunter, builders of the steamer, and they sent out their representative and after several days of effort failed to start the engine. The Toiler was then towed from Montreal to Kingston light, and the owners asked assistance from the American Ship Building Co., Cleveland.

This was promptly given by two members of their engineering department, who, after an hour or two, located the difficulty and the vessel proceeded under her own power to Port Dalhousie to load grain.

This vessel seems very much underpowered, as she only develops about 360 B. H. P. with both engines and has difficulty with the strong current in St. Lawrence river. She is also at a disadvantage owing to the absence of a suitable auxiliary air compressor for maneuvering main engine when in the locks.

The Toiler only makes about six or seven miles an hour.

Last fall the Kingston Ship Building Co. installed a steam boiler and all her auxiliaries when changed over from compressed air to steam, which was found a decided improvement for lock conditions.

## Fishing Schooners With Power

The New England Fish Co., whose headquarters are at Boston, has recently built at the yards of Arthur D. Story, in Essex and Gloucester, Mass., two sister schooners of a modified knockabout type, 126 ft. over all, 102 ft. waterline, 24½ ft. beam, with a mean draft of 10 ft. Each schooner, powered with two Blanchard oil engines, operate two twin screws and develop speed under power alone of about 10½ miles per hour. Both of these vessels have been launched and are now lying at the docks in Gloucester, ready to be equipped with the engines. With their plain pole masts, with no top masts and without the familiar bowsprit, they form a striking contrast to the Gloucester fishing schooners lying alongside. In designing these boats Thomas F. McManus cut down the sail area less than one-half with which boats of this size would be normally equipped, and has considerably shortened the sail base, eliminating the necessity of doing outboard work on the sails.

These oil engine fishing schooners will start at an early date for Seattle. They will run on a fuel oil known as the Star fuel oil and sold on the Pacific coast at a dollar a barrel. The two boats will save over $50 a day in fuel alone as compared with gasoline. In their 90-day trip this will mean thousands of dollars. Gloucester and T Wharf fishermen at Boston are keenly watching the development of these schooners as it is predicted that it will not be many more years before all of the fishing schooners along the northern shores of Massachusetts will be equipped with oil engines, inasmuch as this power is most economical, safe, and the engines are especially suited for heavy duty work, making long, continuous runs without stopping.

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# Isherwood System of Construction*

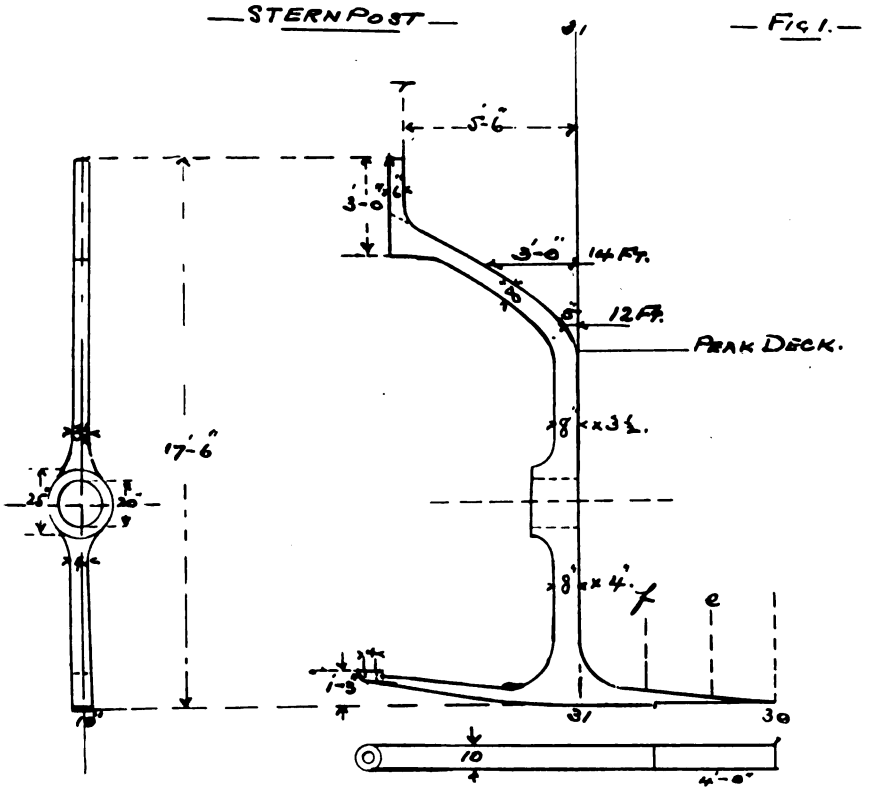
## *Supplying the Loftsman With Sketches of Stem, Stern Post and Cant Frames*

By Robert Curr

OFF sets:—After the lines have been satisfactorily faired up in the drawing office tabulated measurements for the various lines are supplied the loftsman with sketches of stem, stern post and cant frames.

This data is termed the "Off sets" and enables the loftsman to lay the vessel down full size on the mold loft floor.

The first particulars given are as shown here which determine the mid-

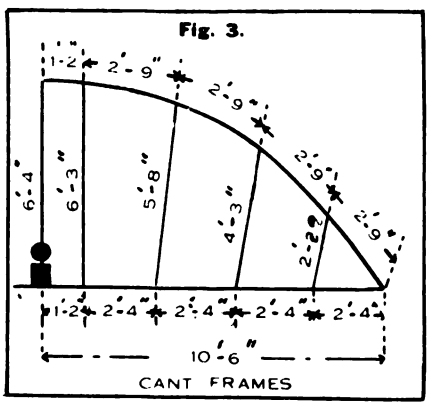



ship section and are seldom changed.

Table I has 13 columns. The first one obtains the sections across ships which are perpendicular in the sheer and at right angles to the center line in the half breadth plan, spaced 6.16 ft. apart. In the body plan they are shown in their true form. The next nine columns are the level lines, which are level in the sheer and body plans but curved and in their true form in the half breadth plan. In the body and sheer plans these lines are spaced above and from the base line 2 ft. apart. To secure the sections in the body plan the points here given are measured on the level lines and a batten bent to same. To get the level lines in the half breadth plan these points are set out on the sections and a batten held to same. The 11th column shows the deck widths and are treated similar to the sections and level lines.

Sheer Heights:—These are given in the last column and when measured above the base on the sections shown in the 12th column and a batten held to same gives the sheer at side.

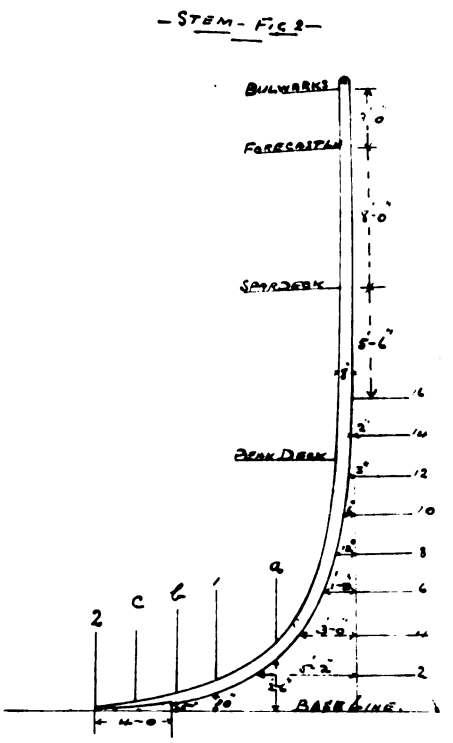
Bow and Buttock Lines: — Are shown in Table II. The first column shows the sections which were explained in Table I, the balance of columns on this table are bow lines to Sec. No. 8, and the balance buttock lines. The bow and buttock lines are spaced 2 ft. apart in the body and half breadth plans, being vertical in the former and horizontal in the latter and in their true form in the sheer plan. The points given in this table are the intersection of the sections in the body plan with the bow and buttocks or the intersection of the buttock and bow lines with sections in the sheer plan. The




points are obtained by measuring on the bow and buttock lines on the body plan and on the sections in the sheer plan above the base line.

Table III gives the longitudinal frames in the body or sheer plans; the letters in the first column represent the longitudinal frames.

The longitudinal frames A, C, D,




E, and F are 2 ft. 8 in. in the bottom from the center line of the ship.

The deck at side is also given in this table, the measurements being

*This is the fifth of a series of articles on the Isherwood System of Ship Construction, which began in the September MARINE REVIEW, the author's purpose being to show every step in the designing of the vessel and estimating the cost of materials and labor. Not a section will be overlooked and the reason will be given for the location of everything in the ship. The first article dealt with the general specifications of the steamer; the second with the sheer, half-breadth and body plans; the third explained the method of getting the sheer; the fourth article dealt with the longitudinal and transverse framing.

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## TABLE I.

### HALF BREADTHS ON LEVEL LINES.

| Transverses. | 2-0 | 4-0 | 6-0 | 8-0 | 10-0 | 12-0 | 14-0 | 16-0 | 18-0 | Deck widths. | Transverses. | Sheer heights. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | | 0-4-0 | 1-7-0 | | | | | | | | S | 21-6-0 |
| 1 | 1-1-0 | 3-2-0 | 4-4-0 | 5-1-0 | 5-8-0 | 6-1-0 | 8-5-0 | 6-8-0 | 7-0-0 | 7-4-0 | 1 | 21-3-0 |
| b | 2-0-0 | 4-7-0 | 6-0-0 | | | | | | | | 2 | 20-9-0 |
| c | 4-4-0 | 6-9-0 | 8-0-0 | | | | | | | | 3 | 20-6-0 |
| 2 | 5-7-0 | 8-3-4 | 9-7-4 | 10-6-0 | 11-7-0 | 12-0-0 | 12-4-4 | 12-0-0 | 13-8-9 | 13-0-0 | 4 | 20-2-0 |
| 3 | 10-9-0 | 12-7-4 | 13-10-0 | 14-4-4 | 15-2-0 | 15-6-4 | 15-10-0 | 16-1-0 | 16-3-4 | 16-6-0 | 5 | 19-1-0 |
| 4 | 14-2-4 | 15-9-4 | 16-8-4 | 17-3-0 | 17-7-4 | 17-10-4 | 18-0-0 | 18-2-0 | 18-3-0 | 18-4-0 | 6 | 19-8-0 |
| 5 | 16-10-0 | 18-1-0 | 18-8-0 | 19-0-0 | 19-2-0 | 19-2-4 | 19-3-0 | 19-3-0 | 19-2-0 | 19-2-0 | 7 | 19-5-0 |
| 6 | 18-4-0 | 19-2-0 | 19-2-4 | 19-9-4 | 19-10-4 | 19-9-4 | 19-8-4 | 19-7-4 | 19-6-4 | 19-5-4 | 8 | 19-3-0 |
| 7 | 18-11-0 | 19-9-0 | 19-9-0 | 19-11-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 9 | 19-0-0 |
| 8 | 19-7-0 | 20-0-0 | 20-0-0 | 20-0-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 10 | 18-10-0 |
| x | 20-0-0 | 20-0-0 | 20-0-0 | 20-0-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 11 | 18-9-0 |
| 21 | 19-7-0 | 20-0-0 | 20-0-0 | 20-0-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 12 | 18-8-0 |
| 22 | 19-3-0 | 19-10-0 | 20-0-0 | 20-0-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 13 | 18-6-0 |
| 23 | 18-7-0 | 19-5-0 | 19-10-0 | 20-0-0 | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-7-0 | 19-6-0 | 14 | 18-5-0 |
| 24 | 17-9-4 | 19-0-0 | 19-8-0 | 19-8-0 | 20-0-0 | 19-9-0 | 19-8-0 | 19-7-0 | 19-6-0 | 19-6-0 | 15 | 18-4-0 |
| 25 | 15-3-0 | 17-6-0 | 18-6-0 | 19-1-0 | 19-3-4 | 19-5-0 | 19-5-0 | 19-3-0 | 19-2-0 | 19-2-0 | 16 | 18-3-0 |
| 26 | 12-7-0 | 15-8-0 | 17-3-0 | 18-1-4 | 18-8-0 | 18-10-0 | 19-0-0 | 18-11-0 | 18-9-4 | 18-9-4 | 22 | 18-3-4 |
| 27 | 9-9-0 | 13-0-0 | 15-1-0 | 16-7-0 | 17-11-0 | 18-2-0 | 18-2-4 | 18-2-4 | 18-2-0 | 18-2-0 | 23 | 18-4-0 |
| 28 | 5-6-0 | 9-3-0 | 12-3-0 | 14-6-0 | 15-10-0 | 16-8-0 | 17-2-0 | 17-4-4 | 17-6-0 | 17-6-0 | 24 | 18-4-4 |
| 29 | 2-9-0 | 5-7-0 | 8-3-0 | 11-0-0 | 13 2 0 | 14-11-0 | 16-10-0 | 16-5-0 | 16-7-0 | 16-7-0 | 25 | 18-5-0 |
| 30 | 1-0-0 | 2-0-0 | 3-8-0 | 6-7-4 | 8-6-0 | 11-6-0 | 13-6-0 | 14-9-0 | 15-4-0 | 15-4-0 | 26 | 18-5-4 |
| 31 | | | | | | 4-6-0 | 9-3-0 | 12-0-0 | 12-5-0 | 15-5-0 | 27 | 18-6-0 |
| T | | | | | | | | | | 10-6-0 | 28 | 18-8-0 |
| d | 1-7-0 | 3-6-0 | 5-9-0 | | | | | | | | 29 | 18-10-0 |
| e | 0-7-0 | 1-0-0 | 2-0-0 | 3-9-0 | 6-6-0 | 10-0-0 | | | | | 30 | 19-0-0 |
| f | 0-5-0 | 0-6-0 | 1-6-0 | 1-9-0 | 3-10-0 | 7-0-0 | | | | | 31 | 19-4-0 |
| | | | | | | | | | | | T | 19-9-0 |
| | | | | | | | | | | | Stern | 20-0-0 |

the heights on the bow and buttock lines above the base. The plan of longitudinal frames in body plan was shown in previous article.

Fig. 1 shows the stern post, Fig. 2 the stem, and Fig. 3 the cant frames, all of which information is necessary to enable the loftsman to fair up the vessel.

### MOLD LOFT OFF SETS.

| | Ft. | In. |
|---|---|---|
| Length over all | 203 | 0 |
| Length between perpendiculars | 192 | 4 |
| Length between stem and stern post inside | 191 | 0 |
| Breadth molded | 40 | 0 |
| Depth | 18 | 3 |
| Depth of waterbottom at center | 3 | 0 |
| Depth of waterbottom at bilge | 2 | 9 |
| Depth of waterbottom at wing | 9 | 0 |
| Transom frame abaft No. 31 transverse | 5 | 8 |
| Rise of floor | ... | 3 |
| Radius of bilge | 3 | 0 |
| Tumble home | ... | 6 |
| Peak decks below spar deck | 8 | 0 |
| Forecastle above spar deck | 8 | 0 |
| Level lines and buttocks spaced apart | 2 | 0 |
| Transverses spaced apart | 6.16 ft. | |
| Longitudinals spaced apart | 2 | 8 |

## TABLE II.

### BOW AND BUTTOCK LINES.

| Transverses. | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |
|---|---|---|---|---|---|---|---|---|---|
| a | | | | | | | | | |
| 1 | 2-6-0 | 5-3-0 | 11-9-0 | | | | | | |
| 2 | 0-6-0 | 1-1-0 | 2-1-0 | 3-6-0 | 6-6-0 | 14-0-0 | | | |
| b | 1-11-0 | 3-4-0 | 4-0-0 | 6-0-0 | | | | | |
| c | 0-11-0 | 1-9-0 | 3-1-0 | 8-0-0 | | | | | |
| 3 | | | 0-3-0 | 0-8-0 | 1-6-0 | 3-3-0 | 6-3-0 | 15-3-0 | |
| 4 | | | | | 0-3-0 | 0-9-0 | 1-10-0 | 4-5-0 | 14-0-0 |
| 5 | | | | | | 0-3-0 | 0-7-0 | 1-5-0 | 3-9-0 |
| 6 | | | | | | | 0-3-0 | 0-5-0 | 1-8-0 |
| 7 | | | | | | | 0-3-0 | 0-5-0 | 1-0-0 |
| 8 | | | | | | | | | 0-9-0 |
| 21 | | | | | | | 0-3-0 | 0-3-0 | 0-6-0 |
| 22 | | | | | | | 0-3-0 | 0-4-0 | 0-10-0 |
| 23 | | | | | | | 0-4-0 | 0-5-0 | 0-4-0 |
| 24 | | | | | 0-2-4 | 0-3-0 | 0-5-0 | 0-10-0 | 2-3-0 |
| 25 | | 0-1-0 | 0-2-0 | 0-3-0 | 0-6-0 | 0-9-0 | 1-4-0 | 2-6-0 | 4-7-0 |
| 26 | 0-1-0 | 0-3-0 | 0-5-0 | 0-9-0 | 1-1-0 | 1-9-0 | 2-8-0 | 4-5-0 | 7-9-0 |
| 27 | 0-3-0 | 0-7-0 | 1-0-0 | 1-6-0 | 2-1-0 | 3-4-0 | 4-9-0 | 7-1-0 | 12-3-0 |
| 28 | 0-6-0 | 1-3-0 | 2-3-0 | 3-3-0 | 4-6-0 | 5-9-0 | 7-6-0 | 10-3-0 | |
| 29 | 1-4-0 | 2-11-0 | 4-4-0 | 5-9-0 | 7-4-0 | 8-11-0 | 10-10-0 | 14-3-0 | |
| d | 1-7-0 | 4-6-0 | 6-3-0 | | | | | | |
| 30 | 4-0-0 | 6-9-0 | 8-5-0 | 9-8-0 | 10-11-0 | 12-6-0 | 14-9-0 | | |
| e | 6-0-0 | 8-4-0 | 9-9-0 | 11-0-0 | | | | | |
| f | 8-5-0 | 10-3-0 | 11-3-0 | | | | | | |
| 31 | 11-1-0 | 11-9-0 | 12-6-0 | 13-5-0 | 14-5-0 | 16-0-0 | | | |
| T | 15-6-0 | 15-9-0 | 16-3-0 | 1610-0 | 18-0-0 | | | | |

## TABLE III.

### LONGITUDINAL FRAMES ON BUTTOCKS.

| Longitudinal frames. | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | Side | Stem. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A, C, D, E and F 2 ft. 8 in. apart from the center line of the vessel, at both ends. | | | | | | | | | | | |
| Fore body. | | | | | | | | | | | |
| G | | | 1-5-0 | 1-4-0 | 1-3-0 | 1-1-0 | 0-10-0 | 16 ft. from center line. | | | |
| H | | | | 3-6-0 | 3-5-0 | 3-2-4 | 2-11-0 | 2-5-0 | 2-2-0 | 1-3-0 | |
| K | 6-0-0 | 5-10-0 | 5-9-4 | 5-9-0 | 5-7-0 | 5-5-4 | 5-2-4 | 4-11-0 | 4-6-0 | 3-8-4 | 5-11-0 |
| M | 8-5-0 | 8-4-4 | 8-3-0 | 8-2-0 | 8-0-0 | 7-10-0 | 7-8-0 | 7-3-0 | 7-2-4 | 6-4-4 | 8-6-0 |
| N | 11-1-0 | 10-11-4 | 10-10-0 | 10-8-0 | 10-6-0 | 10-4-4 | 10-2-4 | 10-1-0 | 9-9-4 | 9-2-0 | 11-2-0 |
| O | 13-0-0 | 13-0-0 | 13-0-0 | 13-0-0 | 13-0-0 | 13-0-0 | 12-10-0 | 12-8-0 | 12-6-0 | 11-9-0 | 13-9-0 |
| P | 16-3-0 | 16-2-0 | 16-0-0 | 15-10-0 | 15-9-0 | 15-7-0 | 15-6-0 | 15-3-0 | 15-0-0 | 15-5-0 | 16-3-0 |
| R | 18-9-0 | 18-7-4 | 18-6-0 | 18-4-4 | 18-3-0 | 18-1-4 | 18-0-0 | 17-10-0 | 17-8-0 | 16-11-0 | 18-10-0 |
| Deck | 21-5-0 | 21-4-0 | 21-3-0 | 21-1-0 | 21-0-0 | 20-10-0 | 20-8-0 | 20-6-0 | 20-3-0 | 19-9-0 | 21-6-0 |
| After body. | | | | | | | | | | | |
| G | | | 3-0-0 | 2-3-0 | 1-7-0 | 1-0-0 | 0-6-0 | 16 ft. from center line. | | | |
| H | | 6-0-0 | 5-2-8 | 4-4-4 | 3-5-0 | 2-9-0 | 2-0-0 | 1-2-0 | 0-9-0 | 0-4-4 | |
| K | 8-9-0 | 7-11-0 | 7-2-0 | 6-4-0 | 5-6-0 | 4-9-0 | 3-9-0 | 3-2-0 | 2-7-0 | 2-3-0 | 9-5-0 |
| M | 11-2-0 | 10-4-0 | 9-6-0 | 8-9-0 | 7-11-0 | 7-1-0 | 6-3-0 | 5-8-0 | 5-1-0 | 4-11-0 | 11-3-0 |
| N | 13-8-0 | 13-1-0 | 12-3-0 | 11-4-0 | 10-5-0 | 9-7-0 | 8-11-0 | 8-2-0 | 7-8-0 | 7-5-0 | 13-10-0 |
| O | | 15-10-0 | 15-2-0 | 14-4-0 | 13-5-0 | 12-6-0 | 11-4-0 | 10-9-0 | 10-3-0 | 10-0-0 | 16-4-0 |
| P | | | 16-5-0 | 16-2-0 | 15-9-0 | 15-9-0 | 14-2-0 | 13-6-0 | 12-11-0 | 12-8-0 | 16-9-0 |
| R | | | | 17-4-0 | 17-1-4 | 16-9-0 | 16-5-0 | 16-0-0 | 15-8-0 | 15-6-0 | 17-9-0 |
| Deck | 20-0-0 | 19-11-0 | 19-10-0 | 19-9-0 | 19-8-0 | 19-7-4 | 19-6-0 | 19-0-0 | 18-9-0 | 18-6-0 | 20-0-0 |

## Some More Investigating

The Interstate Commerce Commission has decided to make a general investigation of the iron ore situation as it presents itself at the docks at Duluth and Superior, when the ore is destined to points beyond those terminals and outside of the state of Minnesota and when such transportation forms a part of the cargo of such ore to a point or points beyond Minnesota. It appears that formal and informal complaints have been made to the commission regarding the rates and practices of the Great Northern, the Duluth, Mesabe & Northern and the Duluth & Iron Range railways. In what manner the rates are unjust and unreasonable is not set forth; nor does the order specify a day upon which the hearing is to be held, because the commission has not yet formulated its data and is not yet prepared to meet the defense that may be made by the carriers mentioned.

The commission has already made inquiry by correspondence regarding the complaints, but it has now decided to put witnesses upon the stand and the carriers whose practices have been challenged will be given ample opportunity for explanation and justification. In this connection also the commission has decided to make an inquiry into the business of water transportation whether conducted on the ocean, the lakes or the rivers of the country.

Instructions were mailed last month to every water carrier engaged in interstate commerce to make a full and complete report as of Jan. 1, similar to the report now required of the railways. Uniform blanks, one providing a form of bal-

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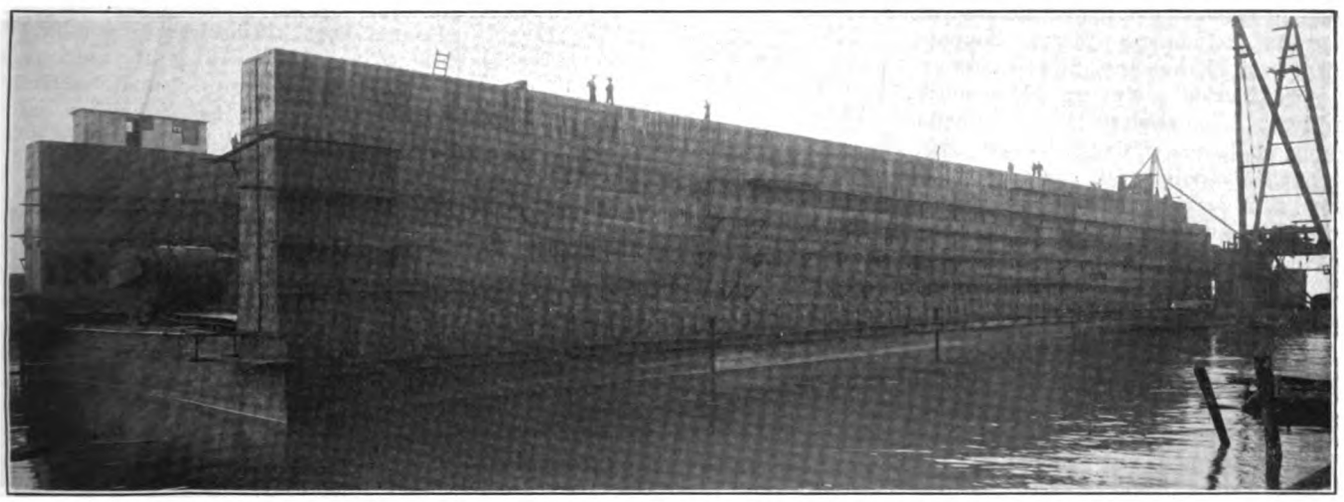
ance sheet statement and the other a form for the classification of expenditures for real property and equipment, have been sent to all companies carrying on a water transportation business. The order of the commission is that all carriers shall keep their accounts in conformity with the classification and general balance sheet forms which have been sent to them. A detailed account of the expenditures of real property is demanded by the commission. It is proposed that these expenditures shall be classified under three general heads—floating equipment, terminal property and general expenditures. Information is wanted as to these three particulars. The floating equipment includes everything in the shape of vessel property. The terminal equipment embraces the mechanical devices on dock for loading and unloading freight, and the general expenditures embrace overhead charges of whatever character, including office force. There does not seem to be a point omitted anywhere.

## New 12,000-Ton Floating Dry Dock

The Seattle Construction & Dry Dock Co., Seattle, Wash., expects to have its new floating dry dock in commission within a few weeks. This new dock is 468 ft. long, 110 ft. wide over all, 85 ft. wide between towers, and has a lifting capacity of 12,000 tons. She will therefore be able to accommodate practically everything visiting Seattle. Much preparatory work was necessary in arranging the site for the dock, especially in dredging. The dock basin was dredged to a depth of 50 ft. in low tide, insuring ample water for the largest class of vessels. The dock is electrically operated and is a most important addition to the company's plant.



NEW 12,000-TON DRY DOCK BUILDING FOR THE SEATTLE CONSTRUCTION & DRY DOCK CO., SEATTLE, WASH.

## New Steel Plant on Detroit River

The United States Steel Corporation has for some years past been picking up land on the Canadian side of the Detroit river about a mile below the town of Sandwich, until the Corporation now owns a tract having a water frontage of nearly two miles and an area of over 1,500 acres. It has long been surmised that the Corporation intended to establish steel works on the tract but no definite announcement of its purpose was ever made. Last week, however, Judge Elbert H. Gary, chairman of the board of directors, issued an official announcement on the subject as follows:

"We have decided to establish a manufacturing plant upon the site which we secured some years ago in Canada, just opposite Detroit. In the comparatively near future we shall commence the construction of some blast furnaces and mills. We shall probably build a wire mill, rail mill, structural mill, bar mill and perhaps some other mills. I suppose the first cost will be in the neighborhood of $20,000,000. The site in question is located at Sandwich, Ont. Some five or six years ago we purchased about 1,300 acres on the Detroit river, giving us a splendid site. We have approximately a mile and a half on the river front where the water is from 25 to 30 ft. deep."

The tract which the Corporation has secured extends from McKee road to Turkey creek, which is right at the head of Fighting island. Much of the land is of a marshy character. Part of the cost of the plant will be financed by an issue of bonds. While no direct announcement has been received of the Corporation's purpose, it is expected that primary construction work will begin in the spring. The disposition of manufacturers has been to regard Canada as a part of the home market and not the export market, though of course they have had to pay the duty imposed upon the entry of steel products into Canada, which averages from $6 to $7 per ton. It is to escape this duty, which in itself works out at a good profit, that the Corporation decided to establish a manufacturing plant in Canada to care for its rapidly growing trade with the Dominion. The location selected is certainly a splendid one, as it possesses every possible facility by land and water and shipments can be made cheaply from it to every part of the Dominion. Deliveries of steel products can very conveniently be made by boat from the plant to the Canadian head of the lakes, giving access to a field which is growing very fast.

The liveliest interest is being manifested in the little town of Sandwich, which can already see itself growing into a second Gary. Detroit steel interests are not concerned over the proximity of their great rival, as the new plant will naturally not compete for business in the United States. It will, however, be a direct competitor with the Algoma Steel Corporation's plant located at Sault Ste. Marie, Ont., and with that of the Hamilton Iron & Steel Co., located at Hamilton, Ont.

The steamer Calgarian, building for the Canadian Interlake Line Ltd., of Toronto, was launched from the Port Arthur yard of the American Ship Building Co. on Dec. 30. She is intended for trade through the Canadian canals.

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# Panama Canal Tolls

## *Dr. Emory R. Johnson, Transportation Expert, Defines His Views on the Subject*

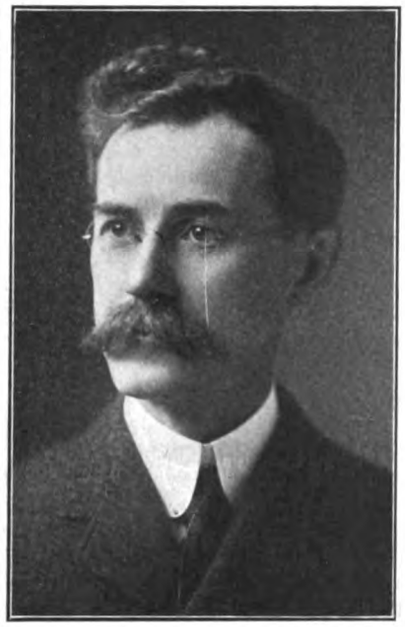
DR. EMORY R. JOHNSON, professor of trade and transportation in the University of Pennsylvania, in a recent interview in *The Daily Iron Trade Review*, stated that he believed that the difference in the cost of building vessels in the United States and abroad rather than the difference in cost of operation was the real reason for the present condition of the American merchant marine engaged in foreign trade. This view is rather surprising because it is contrary to the general belief. During the past two years there has not been much difference in the initial cost of vessels built in the United States and abroad. It was possible, for instance, for the Collingwood Ship Building Co., Collingwood, Ont., to meet the British price on a Canadian bottom. There is, however, a steady handicap in the excess cost of operation and one that never ceases.

During the past decade about $30,000,000 has been expended in American ship yards for the construction of vessels to fly the American flag and to engage in foreign trade. These vessels include the Sierra, Sonoma, Monterey, Kroonland, Siberia, Minnesota, Merida, Mexico, Manchuria, Ventura, Esperanza, Morro Castle, Finland, Korea, Dakota, Havana, Saratoga, Magnolia. Of course that is not a large program and the reason that it is not larger is the handicap of operation.

### *The American Merchant Marine*

Dr. Johnson defines his own views for the upbuilding of the American merchant marine as follows:

"I think it would be well for the United States to follow the policy of Germany, Japan and England in aiding its marine engaged in international trade. It would be well, I think, for the government to give effective aid to at least three ocean lines: One across the North Pacific by way of Hawaii to Japan, China and on to the Philippines; another from New York and New Orleans through the canal down the west coast of South America to Valparaiso; a third from North Atlantic ports, and possibly from gulf ports, down the east coast of South America as far as Buenos Aires. The lines thus aided should be given such support as to enable them thoroughly and effectively to compete with foreign rivals and to grow stronger and of larger tonnage year by year. There should be no half-way measures taken; the government's support should be concentrated and made thoroughly effective."



DR. EMORY R. JOHNSON

Dr. Emory R. Johnson is professor on transportation in the University of Pennsylvania. He has served the government on many commissions as traffic expert, notably the United States Industrial Commission and the National Waterways Commission. President McKinley made him a member of the commission to determine a route for the Isthmian canal and President Taft appointed him as special commissioner on traffic and tolls of the Panama canal. He is regarded as one of the greatest transportation authorities in the United States.

Dr. Johnson, who made an exhaustive investigation of Panama canal tolls at President Taft's request, has recommended, as already published, that merchant vessels pay a toll of $1.20 per net ton when carrying freight or passengers and 40 per cent less when in ballast. He does not deny the right of the American government to remit tolls on its domestic shipping, but in support of his contention that coastwise vessels should pay tolls he says:

"(a)—It is not necessary to exempt the coastwise shipping of the United States from canal tolls as long as foreign-built ships are not allowed to engage in the domestic commerce of the United States. American ship owners having a monopoly of our coastwise trade will charge rates high enough to make their business profitable, and coastwise shipping will be increased in proportion to the growth in demand for transportation facilities.

### *Might Not Lower Rail Rates*

"(b)—The exemption of the coastwise shipping from canal tolls will not result in lower rates by all-rail lines between the two seaboards of the United States. Those who contend that the traffic carried by rail between the eastern and western parts of the United States will be charged rates increased by the rate of the canal tolls assume that the rail charges must be and will be controlled by the coast-to-coast water rates and that the schedule of railroad rates will be fixed at such differentials above the water rates as the railroads can charge and secure traffic in competition with the rival water lines. In order to bring about this adjustment of rail and water rates, there must be: First, active rate-controlling competition among the water lines themselves; secondly, it must be the policy of the railroads to fix rates so as to compete actively with the carriers by water for practically all traffic between the two seaboards.

"Will these conditions exist?

"The competition of the steamship lines with each other will be regulated by conference agreements. Over one-fourth of the traffic between the two seaboards of the United States will be handled by regular steamship lines which by means of their informal organizations or conferences will be able to regulate competition and thus to prevent rates from being forced by competition to a level below which they could not be forced without making business unprofitable. Unless prevented by effective government regulation, the steamship companies engaged in the intercoastal trade will, like the rail companies, effectively regulate competition with each other.

"If this analysis of the relation of steamship companies with each other is correct, it follows that the rates charged by the steamship lines will tend to be not the lowest rates at

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which traffic can be profitably handled, but rates as high as the intercoastal steamship lines think the rates can be made without limiting the growth of traffic or without losing tonnage to the railroad lines. Steamship companies, like railroad companies, will tend to charge what the traffic will bear, and steamship traffic between the two seaboards of the United States will bear such rates as shippers will pay to have their goods transported by water instead of by rail. If this be true, the tendency will be for the steamship lines to adjust their charges with reference to the schedules of railroad rates. Insofar as this practice of rate making prevails, it will be impossible for carriers by water to add canal tolls to their rates. The rates will be the same whether there be canal tolls or not, and if the coastwise carriers are exempted from the payment of tolls, their operating expenses will be reduced by that amount. Rates paid by shippers patronizing the steamship lines will not be affected by the exemption of the coastwise carriers from the payment of Panama canal tolls.

*Doesn't Apply to Charters*

"The foregoing argument does not apply to the rates on chartered vessels. Charter rates will necessarily be increased by the amount of canal tolls. It is not probable, however, that the railroads can, in any event, compete with the carriers by water for bulk cargoes of lumber, coal and similar products. The railroads will be obliged to allow that traffic to move by water. Moreover, charter traffic between the two seaboards of the United States will be limited to a few commodities handled as bulk cargoes or for the exceptionally large shipper. Chartered vessels will not compete with the regular steamship lines to such an extent nor in such a manner as generally to regulate the rates charged by the steamship lines on the greater portion of their traffic.

"(c)—It is argued that American ships should be exempted from Panama tolls in order to give whatever government aid is possible to the American merchant marine. The American merchant marine engaged in the foreign trade needs assistance. Our coastwise shipping has a monopoly of the coastwise trade and does not need further aid. The aid given by the government should be in support of our shipping engaged in foreign trade, and the method that is followed in aiding our marine in foreign trade should be such as to produce definite results.

"The exemption of our shipping engaged in the foreign trade from the payment of tolls, or the repayment of the tolls to the ship owner, would produce very slight results because the subsidy thus granted would be so widely and thinly distributed as to accomplish little, if anything. In order to make a ship subsidy effective, the companies aided must thereby be put in a position to compete successfully with foreign steamship companies. The government must concentrate its aid and so strengthen the strong lines that are given support as to put them in a position to hold their own and grow stronger with foreign rivals.

*Argument in Brief*

"Briefly stated, the same rate of Panama canal tolls should be charged upon American as upon foreign vessels because:

"(1) The omission or repayment of tolls on American shipping engaged in the coastwise trade is not needed.

"(2) The exemption of coastwise shipping from Panama tolls would inure mainly to the benefit of the coastwise carriers and only partially to the benefit of shippers and consumers. Neither the rates of the steamship lines nor the charges of rail carriers will be appreciably higher if tolls are charged on coastwise shipping than they will be if such shipping is relieved from the payment of tolls.

"(3) Such subsidies as are given the American merchant marine should be paid to vessels employed in our foreign trade."

## Forecast of Lake Trade

Lake vessel owners engaged in the bulk freight trade have taken a reckoning of the season's business and find that it is the best that they have enjoyed for several years past. It would not, however, have been a profitable season had it not been for a number of contributary causes, the principal one being unusually heavy movement of grain at very satisfactory rates. If the independent fleets had been compelled to depend upon ore none of them would have earned any money, as even the larger class of carriers has to have excellent dispatch to do much more than break even at 40 cents. The movement of grain, however, was phenomenal and the vessels that were free to engage in it reaped a harvest. The leading independent fleets have declared dividends ranging from 7 to 10 per cent, but some of the smaller independent fleets that were without trade connections did not earn a dividend.

The advance of five cents in carrying charges on ore which is to go into effect next season will make it possible for the more active independent fleets to earn a little money in the ore trade, but will not enable them to declare such dividends as the hazard of the business warrants. Support will have to come from collateral trades to declare a good return upon the investment. However, conservative men in the business are quite content to let the advance in the ore rate remain five cents, as it seeks to discourage the speculative investor—not that there is any field offering in lake trade for the promoter at present.

The general feeling among vessel owners is one of contentment and of hopefulness. They are looking forward to several years of good business and do not believe that any legislative program can disturb it.

## Average Ore Cargo

The average cargo carried on the great lakes during 1912 was 7,740 tons. This was 562 tons greater than the average cargo carried in 1911, due doubtless to more favorable stages of water. It is, however, 585 tons less than the average cargo carried during 1908. The season of 1908 was an extremely poor one on the lakes and very few of the smaller vessels were placed into commission, which accounts for the large average cargo for that year. It is not likely that the record of 1908 in average loads will be broken until more of the smaller class of vessels are retired and stages of water again become ample. Following are the average cargoes for the past eighteen years:

| Year. | Gross Tons. |
|---|---|
| 1895 | 1,830 |
| 1896 | 2,202 |
| 1897 | 3,556 |
| 1898 | 3,517 |
| 1899 | 3,803 |
| 1900 | 3,783 |
| 1901 | 4,459 |
| 1902 | 4,899 |
| 1903 | 6,668 |
| 1904 | 5,272 |
| 1905 | 6,101 |
| 1906 | 6,973 |
| 1907 | 7,516 |
| 1908 | 8,325 |
| 1909 | 7,777 |
| 1910 | 7,155 |
| 1911 | 7,178 |
| 1912 | 7,740 |

## Grain Trade of 1912

The grain trade during 1912 was a revelation and did much to make the closing months of navigation extremely profitable to vessel owners. The crop yield was enormous and more grain was moved on the great lakes during 1912 than ever before. In fact, there never has been a movement

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comparable to it, as it exceeds by over 200,000,000 bushels any previous movement. Much of this grain was moved at figures that worked out from 90 cents to $1.00 as compared with ore, and vessel owners who were in position to take advantage of it were fortunate. Lake grain shipments during the past eight years have been as follows:

| Year. | Bushels. |
|---|---|
| 1905 | 259,168,109 |
| 1906 | 289,929,614 |
| 1907 | 297,150,861 |
| 1908 | 255,487,572 |
| 1909 | 284,670,486 |
| 1910 | 245,171,763 |
| 1911 | 274,029,130 |
| 1912 | 485,150,683 |

## Iron Ore on Lake Erie Docks

Figures compiled by *The Marine Review* from the returns sent in by the various dock companies show that iron ore receipts at Lake Erie ports during the season of 1912 were 37,465,853 tons, out of a total movement of ore by lake of 47,435,777 tons. Lake Erie docks on Dec. 1 held a balance of 9,497,168 tons, which is the largest store on hand in the history of the traffic, the largest previous amount having been 9,426,881 tons, held on Dec. 1, 1910.

During 1911 the total shipment by lake was 32,130,411, of which Lake Erie docks received 25,531,550 tons and held a balance on Dec. 1, 1911, of 9,131,664 tons. During 1910 the total shipment by lake was 42,620,201 tons, of which Lake Erie docks received 34,042,897 tons and held a balance on Dec. 1, 1910, of 9,426,881 tons. During 1909 the total shipment by lake was 41,683,873 tons, of which Lake Erie docks received 33,672,825 tons and held a balance on Dec. 1, 1909, of 8,965,789 tons. During 1908 the total shipment by lake was 25,427,094 tons, of which Lake Erie docks received 20,414,491 tons, and held a balance on Dec. 1, 1908, of 8,441,533 tons. The reserve of 9,497,168 tons is more than will be needed for winter consumption. Never in the history of the trade have 5,000,000 tons gone forward from dock to furnace during the winter season.

Shipments to furnace between May 1 and Dec. 1, 1912, aggregate 33,849,930 tons, compared with 23,178,370 tons in 1911, compared with 30,060,096 tons in 1910, 30,077,304 tons in 1909, 17,453,258 tons in 1908, 29,737,018 tons in 1907, 27,615,392 tons in 1906, 24,311,720 tons in 1905, 16,658,806 tons in 1904, 16,903,013 tons in 1903, and 18,423,364 tons in 1902.

The shipments to furnaces during the season of navigation, as referred to, are determined in this way: First, we have the amount of ore on Lake Erie docks as of May 1, last, 5,881,245 tons; add to this the receipts of the season just closed, 37,465,853 tons, and the total is 43,347,098 tons; deduct the amount on dock Dec. 1, 9,497,168 tons, and we have 33,849,930 tons as the amount that was forwarded either direct or from dock to furnace yards.

It is understood, of course, that the difference between the total output of 47,435,777 which was shipped from the Lake Superior mines during 1912, and the receipts of 37,465,853 tons at Lake Erie ports, is ore that went to places other than Lake Erie ports, such as the furnaces at Lake Michigan ports. The amount of ore on dock May 1, 1912, as given above does not include April receipts, which amounted to 30,399 tons. The accompanying table shows receipts at Lake Erie ports and amounts on dock during six years past.

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

| | 1912. | 1911. | 1910. | 1909. | 1908. | 1907. |
|---|---|---|---|---|---|---|
| Toledo | 1,405,023 | 493,345 | 1,225,202 | 1,374,224 | 680,553 | 1,314,140 |
| Huron | 540,586 | 223,947 | 197,951 | 243,082 | 213,377 | 971,430 |
| Sandusky | ..... | ..... | ..... | 11,088 | ..... | 83,043 |
| Lorain | 3,771,350 | 2,937,605 | 2,884,738 | 2,796,856 | 2,286,388 | 2,621,025 |
| Cleveland | 7,914,836 | 4,584,211 | 6,344,943 | 6,051,342 | 4,240,815 | 6,495,998 |
| Fairport | 1,810,381 | 666,365 | 1,516,434 | 1,734,277 | 1,518,961 | 2,437,649 |
| Ashtabula | 8,158,080 | 6,359,131 | 9,620,638 | 8,056,941 | 3,012,064 | 7,521,859 |
| Conneaut | 7,839,831 | 6,931,278 | 6,309,548 | 7,007,834 | 4,798,631 | 5,875,937 |
| Erie | 547,067 | 289,400 | 942,592 | 1,235,057 | 828,602 | 2,294,239 |
| Buffalo | 5,060,642 | 2,802,976 | 4,704,439 | 5,002,235 | 2,835,099 | 5,580,438 |
| Detroit | 418,057 | 243,292 | 296,412 | 159,889 | ..... | ..... |
| Total | 37,465,853 | 25,531,550 | 34,042,897 | 33,672,825 | 20,414,491 | 35,195,758 |

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

| | 1912. | 1911. | 1910. | 1909. | 1908. | 1907. |
|---|---|---|---|---|---|---|
| Toledo | 552,016 | 661,382 | 433,215 | 332,456 | 590,925 | 518,645 |
| Sandusky | 2,472 | 2,471 | 17,728 | 39,557 | 36,079 | 44,546 |
| Huron | 385,810 | 344,371 | 375,118 | 477,333 | 458,158 | 415,730 |
| Lorain | 320,713 | 314,321 | 259,448 | 407,129 | 426,274 | 366,271 |
| Cleveland | 1,888,560 | 1,589,491 | 1,638,795 | 1,547,142 | 1,458,392 | 1,281,335 |
| Fairport | 565,920 | 636,566 | 839,970 | 867,640 | 835,821 | 523,981 |
| Ashtabula | 3,350,553 | 3,295,862 | 3,287,816 | 2,594,359 | 2,293,531 | 2,056,820 |
| Conneaut | 1,429,533 | 1,237,573 | 1,329,997 | 1,411,002 | 1,296,675 | 1,000,774 |
| Erie | 661,330 | 636,274 | 792,011 | 788,046 | 730,530 | 652,219 |
| Buffalo | 340,261 | 413,353 | 452,783 | 501,125 | 315,148 | 435,407 |
| Total | 9,497,168 | 9,131,664 | 9,426,881 | 8,965,789 | 8,441,533 | 7,385,728 |

## Lake Michigan Ore Receipts

Out of a total lake movement of 47,455,777 gross tons of ore, Lake Michigan ports received 8,357,070 tons, distributed as follows:

| Port | Gross tons. |
|---|---|
| Elk Rapids, Mich. | 47,947 |
| East Jordan, Mich. | 42,878 |
| Milwaukee, Wis. | 138,065 |
| Gary, Ind. | 2,088,327 |
| Indiana Harbor, Ind. | 514,748 |
| South Chicago, Ill. | 5,480,105 |
| Boyne City, Mich. | 45,000 |
| Total | 8,357,070 |

## New Type of Lifeboat

A test of a new kind of lifeboat was made on the car ferry Ashtabula in Ashtabula harbor on Monday, Jan. 6, and as a result it has been adopted as part of the life-saving equipment of the car ferry. The boat is of the Uraed type, invented by Capt. Ole Brude, who sailed across the ocean in 1904 in a similar craft. The boat is in the shape of an egg and is obviously entirely covered over. It is provided with a sliding keel to prevent drifting and rolling. On the top there is a railing and lookout tower from where the helmsman has a complete view all around through four glazed portholes. The bow is provided with a double bottom which is divided into four watertight compartments, through which there is access through manholes. The compartments are intended for storing provisions, water and other necessities. If in the case of sudden disaster there is no time to get the boat overboard, it may be simply released from its tackles and will float on the water as the ship goes down.

## Coal Movement During 1912

Soft coal shipments on the great lakes, including both cargo and fuel coal, amounted to 23,335,000 tons during 1912, being 1,552,305 tons greater than shipments during 1911. These figures are rather surprising as the movement of soft coal through the canals at Sault Ste. Marie was 483,558 tons less than the 1911 movement, and it was generally supposed that the total movement would be less than that of 1911, as vessels certainly did not appear to be busy carrying coal from Lake Erie ports at any time during the season. The movement of cargo coal was probably higher than during 1911 and the difference is to be found in fuel coal. There were many more ships in commission during 1912 than in 1911, and, of course, a great deal more coal was consumed by them.

Hard coal shipments during 1912

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were 4,204,741 tons. Hard coal shipments for the past eight years were as follows:

| Year. | Gross tons. |
|---|---|
| 1912 | 4,204,741 |
| 1911 | 3,917,419 |
| 1910 | 3,639,368 |
| 1909 | 3,052,706 |
| 1908 | 3,538,098 |
| 1907 | 3,449,695 |
| 1906 | 2,681,808 |
| 1905 | 2,785,362 |

Looking back for a decade the coal trade exhibits a most creditable growth. It has more than doubled in ten years and as the northwest expands it will increase. The time is probably coming when the coal trade will equal the ore trade of the lakes. The lake tonnage of soft coal from all districts for the past twelve years is shown in the accompanying table:

| Year. | Pittsburgh. | Ohio. | West Virginia. | Total. |
|---|---|---|---|---|
| 1901 | 3,795,706 | 1,954,825 | 787,572 | 6,538,103 |
| 1902 | 4,704,093 | 2,689,974 | 965,769 | 8,359,636 |
| 1903 | 6,092,047 | 2,458,265 | 1,539,435 | 10,089,747 |
| 1904 | 6,058,383 | 2,138,247 | 1,279,876 | 9,476,506 |
| 1905 | 7,443,883 | 2,062,692 | 2,109,262 | 11,615,837 |
| 1906 | 9,287,272 | 2,560,906 | 2,743,732 | 14,591,910 |
| 1907 | 10,549,995 | 4,074,296 | 3,420,941 | 18,037,232 |
| 1908 | 8,700,000 | 3,600,000 | 3,450,000 | 15,750,000 |
| 1909 | 8,687,395 | 3,002,815 | 3,874,570 | 15,564,690 |
| 1910 | 11,911,900 | 4,297,300 | 6,629,500 | 22,838,700 |
| 1911 | 10,611,941 | 4,019,544 | 7,151,200 | 21,782,685 |
| 1912 | 11,300,000 | 4,676,000 | 7,360,000 | 23,335,000 |

## Average Stay in Port

Herewith is published a comparative statement for the years 1906, 1910, 1911 and 1912, giving the average stays at upper and lower lake ports of the vessels of the Pittsburgh Steamship Co. Based upon the figures of 1906 it will be noted that the time of loading and unloading was almost cut in half in 1910, while 1911 showed a decided increase in efficiency over 1910. In fact, the general record of dispatch made in 1910 was not equaled during 1912, but it must be borne in mind that 1911 was a year of greatly lessened traffic and that therefore there were fewer ships to be handled at docks and consequently a greater state of preparedness to receive them.

AVERAGE STAY IN PORT

| | Year 1906. Hrs. min. | Year 1910. Hrs. min. | Year 1911. Hrs. min. | Year 1912. Hrs. min. |
|---|---|---|---|---|
| Average stay in lower lake ports.. | 36 15 | 22 22 | 17 29 | 20 9 |
| Average stay in upper lake ports.. | 22 25 | 12 22 | 10 50 | 11 51 |
| Average time spent in port receiving and discharging cargoes..... | 58 38 | 34 44 | 28 19 | 32 .. |
| | Gross tons | Gross tons | Gross tons | Gross tons |
| Average cargo carried ..... | 5,954 | 6,634 | 6,306 | 6,796 |
| Largest cargo carried ..... | 13,333 | 13,296 | 11,159 | 13,037 |
| Fastest loading record ..... | 9,277 tons in 70 min. | 9,788 tons in 45 min. | 9,362 tons in 25 min. | 10,325 t's in 2 hr. 30 min. |
| | Tons per hr. | Tons per hr. | Tons per hr. | Tons per hr. |
| Rate of fastest loading record..... | 7,288 | 13,051 | 22,469 | 4,136 |

## Commerce of Lake Superior

The report of the superintendents of canals at Sault Ste. Marie shows that 22,778 ships of 56,736,807 net tons register passed through the canals during 1912. Of this number 14,916 of 30,947,133 net tons used the United States canal and 7,862 vessels of 25,789,674 net tons used the Canadian canal. The total freight movement was 72,472,676 net tons, of which 32,824,815 tons were carried through the United States canal, and 39,647,861 tons through the Canadian canal. The movement of freight is 10,109,458 tons greater than that of 1910. It will be seen that, while the number of vessels using the Canadian canal is only half the number using the American canal, yet the Canadian canal carries the greater portion of freight, proving, conclusively, that the larger class of vessels use the Canadian canals.

The United States canal opened on April 24 and closed Dec. 16, a season of 237 days. The Canadian canal opened April 24 and closed Dec. 19, a season of 240 days.

| Items. Vessels. | | Total Traffic for Season 1911 | Season 1912 | Increase or Decrease Amount | Per Cent. Inc. | Dec. |
|---|---|---|---|---|---|---|
| Steamers | Number.. | 15,160 | 19,076 | 3,916 | 26 | |
| Sailing | Number.. | 1,681 | 1,805 | 124 | 7 | |
| Unregistered | Number.. | 1,832 | 1,897 | 65 | 4 | |
| Total | Number.. | 18 673 | 22,778 | 4,105 | 37 | |
| Lockages | Number.. | 13,292 | 16,088 | 2,796 | 21 | |
| Tonnage: | | | | | | |
| Registered | Net..... | 41,653,488 | 56,736,807 | 15,083,319 | 36 | |
| Freight | Short..... | 53,477,216 | 72,472,676 | 18,995,460 | 36 | |
| Passengers | Number | 79,951 | 66,877 | 13,074 | | 16 |
| Coal: | | | | | | |
| Hard | Short tons | 2,060,209 | 2,142,485 | 82,276 | 4 | |
| Soft | Short tons | 13,272,667 | 12,789,109 | 483,558 | | 4 |
| Flour | Barrels... | 7,246,495 | 8,652,153 | 1,405,658 | 19 | |
| Wheat | Bushels... | 97,141,911 | 174,086,456 | 76,944,545 | 79 | |
| Grain | Bushels... | 40,782,609 | 69,024,546 | 28,241,937 | 69 | |
| Mfd. & Pig Iron | Short tons | 412,269 | 654,892 | 242,623 | 59 | |
| Salt | Barrels... | 661,308 | 662,991 | 317 | | .. |
| Copper | Short tons | 132,481 | 116,954 | 15,527 | | 12 |
| Iron Ore | Short tons | 30,731,235 | 46,303,423 | 15,572,188 | 51 | |
| Lumber | M.ft. B.M. | 558,513 | 667,542 | 109,029 | 20 | |
| Building Stone | Short tons | 5,342 | 2,282 | 3,060 | | 57 |
| General Mdse | Short tons | 1,385,918 | 1,664,783 | 278,865 | 20 | |

## Power Tanker Radium

One of the largest commercial power boats to go into commission this year is Radium, which has just been turned over to her owners, the Gulf Refining Co., of Port Arthur, Texas, by the Skinner Shipbuilding & Drydock Co., of Baltimore.

Radium is practically an all-steel vessel, 153 ft. long, 24 ft. beam and 12 ft. 6 in. depth of hold. When laden to her capacity of 180,000 gallons of cargo oil and 12 tons of fuel oil she draws 11 ft. of water.

Her motive power is a 300 H. P. Standard engine which turns a three-bladed propeller and gives her a speed of little better than 8 miles an hour when loaded. Her pumping engine which drives four pumps is a 20-H. P. Fairbanks-Morse motor and she gets electric current from a 2-k. w. dynamo coupled to a 3-H. P. Standard engine. She also has a set of batteries for lighting when the dynamo is not running.

In every respect, save one, Radium is built like the latest models of steam tankers. Her eight tanks are self-sustained and are piped so that oil may be pumped from one to the other. In addition she has a fore hold that will carry about 50 barrels. The barrels are handled by means of a cargo mast and boom and motor hoist, the latter operated from the pilot house.

POWER BARGE RADIUM

She is fully equipped for cruising and has all of the conveniences of the power yacht for a crew of five.

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She has been placed in service and will be used between New York and Cape May as a supply boat for the company's stations.

## Nicholson Ship Log

The Nicholson Ship Log Co., of Cleveland, have perfected an electrical attachment for its instruments which enables it to equip any class of vessel with the log. The pipe can now be placed in any part of the ship most suited for it and, by a three-wire system, the changes in speed, as indicated by the floats in the pipe, are transmitted to the log which is usually placed in the chart room or on the bridge. Lake freighters can now have this log installed which was not practical with the mechanically-driven type, owing to the inability to place the pipes close to the log.

The electric lighting circuit of the vessel when available is used for the log, otherwise batteries are used. The features of the former type of log are retained, namely, Speed dial, Distance counter and Paper record. The mechanically-driven type of instrument is still continued for use where close connection can be made with the log and pipe.

## Johns-Manville Co.'s New Plant

The new plant of the H. W. Johns-Manville Co., at Manville, N. J., opened with the new year. It occupies a tract of 320 acres divided by the Raritan river in the town formerly known as Findern, but now changed to Manville. The company's private railroad system, comprising five miles of tracks, makes connections with three railways, insuring excellent shipping facilities. About 3,000 men are employed in the new plant, making a total of about 7,000 now in the employ of the company.

The new plant consists of nine buildings, classified as follows: A, textile and packing; B, rubber plant, electrical specialties and printing department; C, pipe covering; D, paper mill; E, magnesia; F, roofing; G, mastick and water-proofing, and H, roofing coatings, power plant and pump house.

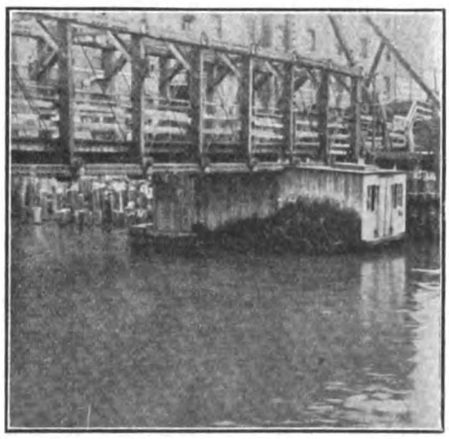
The buildings represent the most advanced ideas in fireproof construction, being brick, steel and concrete, and obviously with roofs of J.-M. asbestos roofing. The daylight form of construction has been adopted. The walls, ceilings and uprights are coated with J.-M. fireproof cold water paint and artificial illumination is provided in the form of J.-M. Linolite lamps and Frink reflectors. The power plant consists of the latest type of General Electric turbo generators, and six Babcock & Wilcox high pressure water-tube boilers, aggregating 5,000 H. P.

## Floating Mattress

Lieut. S. P. Edmonds, 104 Newburg avenue, Catonsville, Md., has invented a floating mattress which was recently tried out on the army transports Meade and Kilpatrick, at Newport News, Va., by the army board on lifeboats and life saving appliances. The mattress is made to fit any bunk and is said to be as comfortable as an ordinary felt mattress. In the even of disaster they can be used singly or as rafts. In the demonstration Lieut. Edmonds maneuvered a 24-inch mattress, which is the smallest made for sleeping purposes, about the harbor basin with one oar. The raft was then weighted in the water and secured alongside of the transport Meade for flotation tests. On the fourth day the raft showed no signs of sinking. The mattress was then torn and the filling punctured and after 10 days waiting in the water still showed no signs of sinking. Lieut. Edmonds intends to further demonstrate the mattress before the United States board of steam inspectors.

## Unusual Function for a Boat

The accompanying illustration shows a most unusual function performed by a very odd-shaped boat on the north branch of the Chicago river, at Indiana street, last summer. The

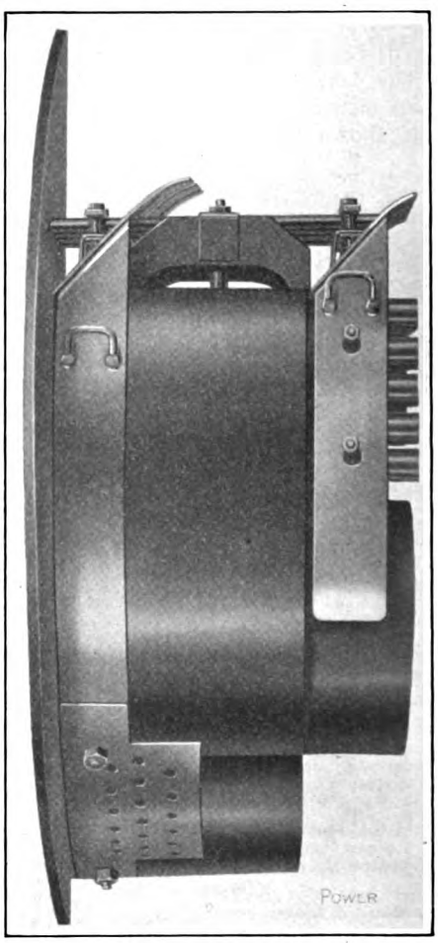


SINGULAR SERVICE FOR A BOAT

boat is securely braced by upright timbers to the bridge and is operated by side wheels driven by an electric motor. When it was desired to swing the bridge the current was turned on and the boat with its queer craft described a quarter circle across the stream. The boat simply backs up when it desires to restore the bridge to its original position.

## Ross Schofield Circulator

Alexander Hynd, 872-874 Rockefeller building, Cleveland, has become the great lakes agent for the Ross Schofield system of circulation for Scotch marine boilers. Mr. Hynd has in his office a working model of a Scotch boiler equipped with the




SIDEVIEW OF COMBUSTION CHAMBER SHOWING APPLICATION OF ROSS SCHOFIELD CIRCULATOR

system and extends an invitation generally to lake engineers to inspect it in actual operation. The device is well shown in the accompanying illustrations. It consists of a steel plate supported on short stays completely enclosing the water space back of the combustion chambers except at the top and between the furnaces at the bottom; also steel plates placed in front of the combustion chambers and on each side of each furnace or bank of tubes; also a back hood and a front hood. The plates can be attached without mutilating the

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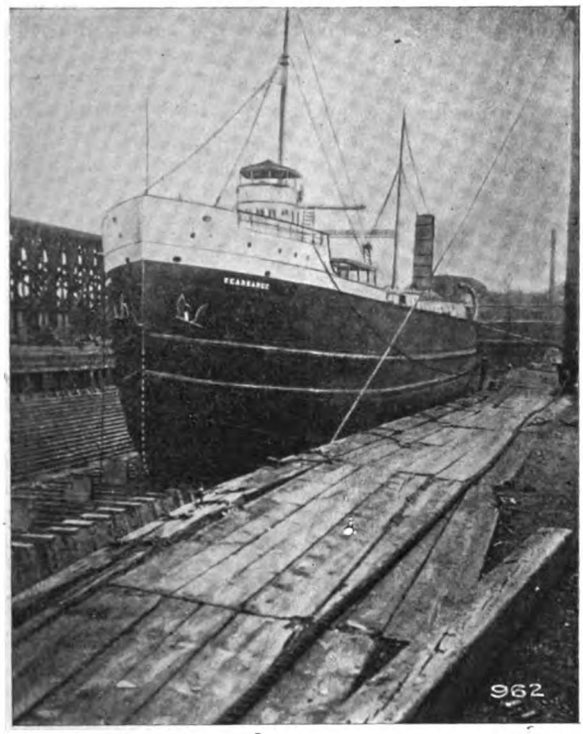
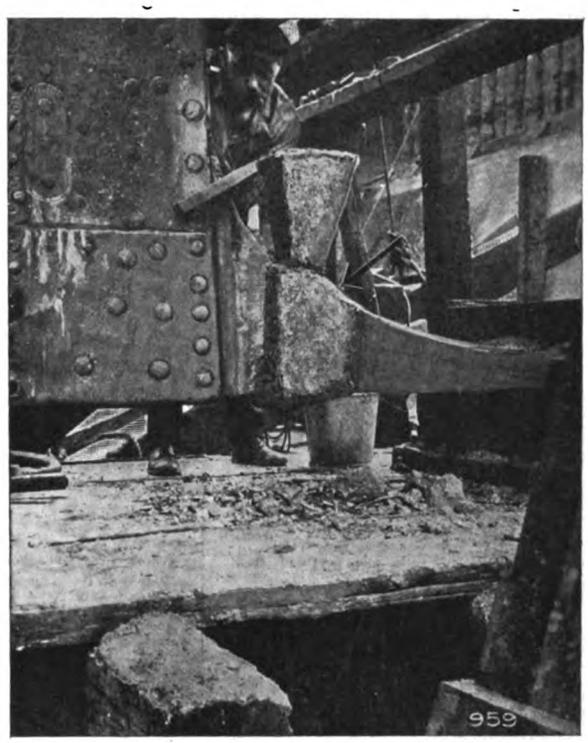



Steamer "Kearsarge" in Drydock of the Chicago Ship Building Co., So. Chicago, Ill.




Weld Made on Stern Post of Steamer "Kearsarge," Showing Metal Left in Riser

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## We Execute Such Repairs on Short Notice and Do Not Keep the Vessel Out of Commission More than Two or Three Days

The quick repair of Stern frames, Rudder frames, Rudder posts, Crank shafts, Connecting rods and other broken sections of wrought iron and steel is our specialty. We weld broken sternposts without any dismantling of the vessel and at a tremendous saving in time and expense. The saving in cost of dockage alone is a very large item.

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# GOLDSCHMIDT THERMIT COMPANY

**WILLIAM C. CUNTZ, General Manager**

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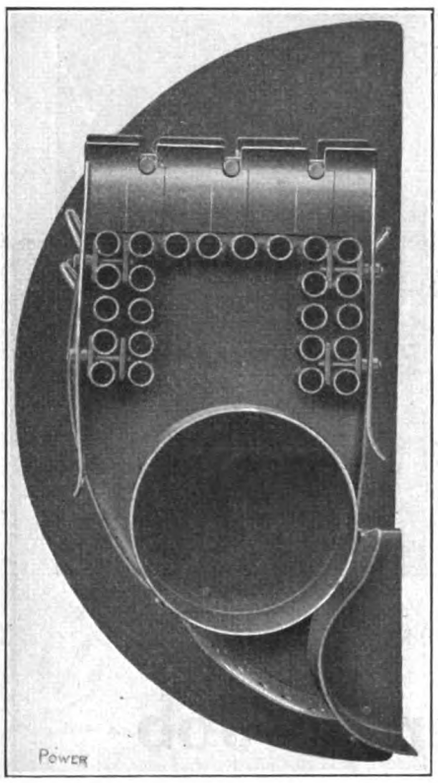
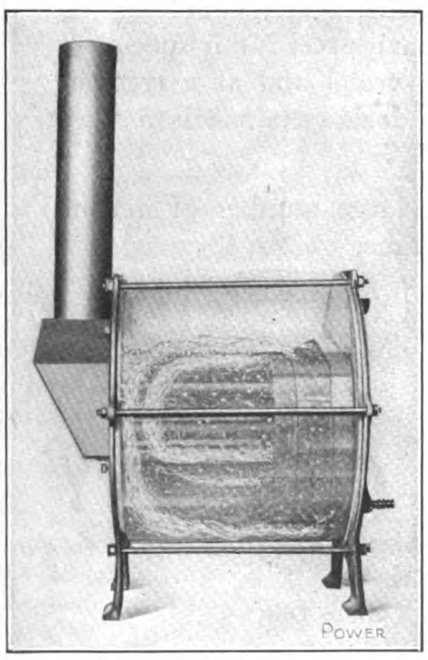
boiler in any way, being simply hooked onto the stays or boiler tubes. It can be seen that two spaces are thus provided which operate in parallel, the superimposed curved hoods promoting longitudinal and elliptical circulation of the water by utilizing




FRONT VIEW OF COMBUSTION CHAMBER

the natural force of the steam bubbles.

The end sought certainly seems to be achieved in the model. The bubbles pass up through the guiding compartments formed by the circulator plates and issuing from the curved hoods throw the ascending streams of water in a horizontal direction instead of upwards toward the steam space. The effect is to promote a flow as to continuously draw the water from the lower part of the boiler up between the plates of the circulator and propel it longitudinally towards the front, equalizing temperature, establishing circulation and promoting rapid steaming.




MODEL OF SCOTCH BOILER WITH ROSS SCHOFIELD CIRCULATOR

The device has been adopted by quite a number of steamship companies, including the Holland-Amerika Line, the Leyland Line, the Ward Line, Red Star Line, the Coastwise Transportation Co., and the New England Coal & Coke Co.

## Englehardt Collapsible Lifeboats

The new Hamburg-American liner Imperator, of 50,000 tons capacity, now building, will carry 43 Englehardt collapsible lifeboats. The Englehardt is the only collapsible lifeboat passed and recommended by the United States steamboat inspection service, and it has also been admitted to the lifeboat section by the British board of trade. This lifeboat when folded is only 18 in. in height, so that several of them nested fill no more space than one boat of the ordinary type. The Englehardt boat is not dependent upon air tanks which, of course, need constant inspection. It is a very cheap boat to keep in repair, and experience has proved that after 10 years of service they have lost none of their good qualities.

The following claims are made for the Engelhardt boat:

No lifeboat can in damaged condition support the same passengers as the Engelhardt collapsible lifeboat.

Its construction is a guarantee that no accident can render it useless.

Should the davit tackles foul, these boats can be launched overboard when folded and expanded while afloat.

If the boat goes down so suddenly that even this cannot be accomplished, the grip hooks need only be released, when their great buoyancy will immediately bring the boats to the surface, offering easier access to people struggling in the sea than any other boat.

Even if not expanded, the boats will float with a greater number of passengers than the Board of Trade's measurement allows them to accommodate when in boat shape.

The boat can be expanded by two men in a few seconds, and as quickly on the sea as on deck.

A 28 ft. Engelhardt Collapsible Life Boat, Floating with 60 People.

## Stirling Water Tube Boiler

The Babcock & Wilcox Co., 85 Liberty street, New York, has just issued a book, excellently bound in cloth, descriptive of the Stirling water tube boiler. The book is a complete history of the Stirling boiler, which was first manufactured commercially by the International Boiler Co. of New York in 1889. The Stirling Boiler Co. was formed in 1890 and in 1907 the business was acquired by the Babcock & Wilcox Co. The book contains a complete description of the boiler to the least detail and is illustrated with a number of excellent photographs and wash drawings.

The E. J. Codd Co., Baltimore, Md., have a number of orders on hand for complete machinery outfits for several small vessels.

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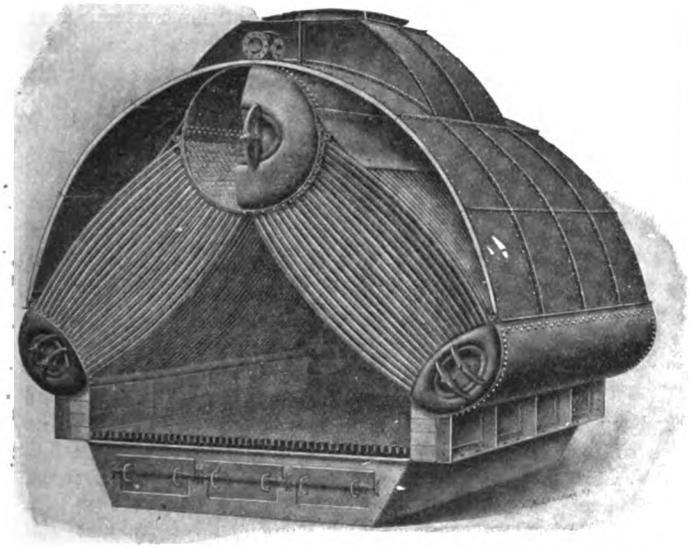
# Mosher Water Tube Boilers



Adapted for the highest grade service, Torpedo Boats, Destroyers, Battleships, and large commercial vessels. Steam drums up to six feet in diameter, larger water and steam room capacity than any other boiler.

Any tube can be replaced without disturbing any others. Fifty tubes removed through one hand-hole. Curvature of tubes just sufficient to avoid expansion troubles. Greatest facility for cleaning interior and exterior of tubes. No screwed joints, all tubes expanded. All parts of wrought steel. Send for catalogue.

**MOSHER WATER TUBE BOILER CO.**
**30 Church Street, NEW YORK**

# The Babcock & Wilcox Co.
**NEW YORK and LONDON**

**Forged Steel**

**Marine Water-Tube Boilers**

**and**

**Superheaters**

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**Naval Vessels** **Merchant Steamers**
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These boilers hold the record for economy, capacity and endurance in the Navies of the World.

They have shown the same characteristics in the Merchant Marine. Babcock & Wilcox Boilers and Superheaters in one vessel are *saving more than 15 per cent.* over Scotch boilers in sister vessels.

*Is a reduction in your coal bill of any interest to you?*

Babcock & Wilcox Boilers have all essential parts heavier than corresponding parts in Scotch boilers, giving greater security against corrosion. They are lighter, safer, easier to clean and to operate than Scotch boilers, and much more efficient.

We are constantly receiving "repeat orders" from owners of merchant vessels who have had many years' satisfaction from the earlier installations.

**Write us for details**

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¶ The Corrugated-Steel, Asbestos-Covered, Graphite-Coated Gasket that's guaranteed for five years of continuous service.

¶ The Gasket for extremes of pressure and temperature—for superheated or saturated steam—for permanently tight joints.

¶ The Gasket that you can try for 90 days at our risk. The Gasket that's free if it fails. The Gasket that costs least by the year—That's DEVO—the Dependable. Try it. Put DEVO on your program for higher efficiency, less cost and less labor this year.

¶ Write for descriptive circular and complete catalog of packings for all power plant purposes.

# GOETZE Gasket & Packing Co.
**26 Allen Avenue, New Brunswick, New Jersey**


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## Vessels Built on Isherwood System

There are in service or under construction, 240 vessels on the Isherwood system, representing a gross tonnage of 1,078,151. The division of these vessels among countries is as follows:

| | Vessels. | Gross register. |
|---|---|---|
| United Kingdom | 145 | 710,671 |
| United States | 53 | 201,137 |
| Germany | 22 | 109,197 |
| Holland | 10 | 26,386 |
| Canada | 5 | 15,800 |
| Belgium | 4 | 11,460 |
| France | 1 | 3,500 |
| Total | 240 | 1,078,151 |

Of the oil tankers contracted for during 1912, by far the greater portion are on the Isherwood system and up to the present time 81 vessels of this type have been built. Among the more prominent vessels of the Isherwood system launched during 1912 were the Vestris of the Lamport & Holt Line, the Maiden for T. & J. Brocklebank, of Liverpool, the bulk freighter James A. Farrell for the Pittsburgh Steamship Co., and the colliers Orion and Jason for the United States navy department.

## Personal

**Robert Curr** has been appointed one of Lloyd's surveyors at Port Arthur.

**H. Gansslen,** president and mechanical engineer of the Cook & Chick Co., Chicago, recently visited Cleveland to close up contracts for machine work in connection with the winter fleet at Chicago.

**Capt. C. A. Allen,** of Kentville, N. S., has been engaged by the United Fruit Co. to open an office in Halifax to handle the company's apple business.

**A. A. Schantz,** general manager of the Detroit & Cleveland Navigation Co., has been elected second vice president of the company.

**J. Bruce Ismay** has resigned as president of the International Mercantile Marine Co. and will be succeeded by Harold H. Anderson, formerly vice president.

**J. E. McLurg** has been appointed superintendent of sales of the Algoma Steel Corporation. S. V. McLeod succeeds him as superintendent of the Algoma Central Steamship Line.

**W. S. McChesney,** president of the Terminal Railroad Association of St. Louis, has been elected president of the Wiggins Ferry Co., to succeed W. K. Kavanaugh, resigned.

**H. L. Tims** has been appointed superintendent of the Harlan & Hollingsworth Corporation at Wilmington, Del. Mr. Tims served his apprenticeship as a shipbuilder at Wyandotte. He went to the old Cleveland yard in 1888 and when the American Ship Building Co. was formed he became foreman of the plant at Lorain. During the past 10 years he has been successively general superintendent at Bay City, South Chicago, and Port Arthur. He was very popular on the lakes.

## Trade Notes

The H. W. Johns-Manville Co. has appointed C. S. Berry as manager of their Atlanta, Ga., office, located at 31 South Broad street.

The Automatic Steam Trap & Specialty Co., manufacturers of the Barton automatic steam trap, have decided to combine their Cleveland, Toronto and Detroit offices under one roof. The company's headquarters hereafter will be 316-320 Harper avenue, Detroit, Mich.

The Joseph Dixon Crucible Co., Jersey City, N. J., announces a reduction in the selling price of its silica graphite paint, corresponding to the decrease in the price of linseed oil. This paint has beeen a standard one for nearly 50 years in the preservation of all exposed steel and metal surfaces.

## Obituary

**Capt. Alfred Beaupre,** who last year commanded the barge Manila, of the Pittsburgh Steamship Co.'s fleet, died at his home at Kingston last month.

**Capt. Benjamin Moshier** died at his home in Cleveland on Dec. 30. He had followed the lakes since a boy, his last command being the Perry G. Walker, of the Gilchrist fleet.

**Frank W. Gilchrist,** of Alpena, Mich., who for many years occupied a commanding position as a lumber man and ship owner, died at Memphis, Tenn., quite suddenly on Dec. 13.

**Eben Smith Wheeler,** for many years civilian engineer in the government service, died in Detroit on Jan. 5, at the age of 74 years. He had been identified with many government engineer enterprises on the lakes, notably lighthouses and the locks at the Sault. He was one of a commission appointed to examine the Nicaragua route for the Isthmian canal in 1897.

## Who's Suit Case is This?

John C. Leacy, traveling freight agent of the Great Northern railway, 226 Portage avenue, Winnipeg, Man., accidentally exchanged suit cases on Dec. 23 at Sudbury, Ont., on Canadian Pacific train No. 2, east bound sleeping car "Savanne", leaving one belonging to his sister. He believes the suit case belongs to some lake captain or engineer. The only identification mark on the contents is "W. A. W. Haig" on the collars.

### SUMMARY OF NAVAL CONSTRUCTION

| Number and name of vessel. | | Contractor. | Dec. 1, 1912. Total. | Per cent. on ship. |
|---|---|---|---|---|
| | | **Battleships.** | | |
| 34 | New York | New York Navy Yard | 65.7 | 61.6 |
| 35 | Texas | Newport News Ship Building Co | 80.7 | 78.2 |
| 36 | Nevada | Fore River Ship Building Co | 12.3 | 3.0 |
| 37 | Oklahoma | New York Ship Building Co | 11.2 | 4.9 |
| | | **Torpedo Boat Destroyers.** | | |
| 39 | Henley | Fore River Ship Building Co | 99.3 | 99.3 |
| 43 | Cassin | Bath Iron Works | 65.2 | 64.5 |
| 44 | Cummings | Bath Iron Works | 57.9 | 56.0 |
| 45 | Downes | New York Ship Building Co | 31.5 | 26.4 |
| 46 | Duncan | Fore River Ship Building Co | 51.2 | 48.8 |
| 47 | Aylwin | Wm. Cramp & Sons | 74.7 | 73.1 |
| 48 | Parker | Wm. Cramp & Sons | 64.1 | 61.5 |
| 49 | Benham | Wm. Cramp & Sons | 62.5 | 60.0 |
| 50 | Balch | Wm. Cramp & Sons | 69.0 | 67.1 |
| | | **Submarine Torpedo Boats.** | | |
| 23 | F-4 | Electric Boat Co. (Seattle) | 94.6 | 94.6 |
| 26 | G-4 | American Laurenti Co. (Philadelphia) | 88.3 | 87.4 |
| 27 | G-2 | Lake Tow Boat Co. (Bridgeport) | 86.0 | 85.9 |
| 28 | H-1 | Electric Boat Co. (San Francisco) | 86.0 | 85.3 |
| 29 | H-2 | Electric Boat Co. (San Francisco) | 85.8 | 85.1 |
| 30 | H-3 | Electric Boat Co. (Seattle) | 83.3 | 80.3 |
| 31 | G-3 | Lake Tow Boat Co. (Bridgeport) | 60.5 | 57.0 |
| 32 | K-1 | Electric Boat Co. (Quincy) | 58.0 | 53.5 |
| 33 | K-2 | Electric Boat Co. (Quincy) | 57.9 | 53.4 |
| 34 | K-3 | Electric Boat Co. (San Francisco) | 62.2 | 60.9 |
| 35 | K-4 | Electric Boat Co. (Seattle) | 57.2 | 51.9 |
| 36 | K-5 | Electric Boat Co. (Quincy) | 42.8 | 37.6 |
| 37 | K-6 | Electric Boat Co. (Quincy) | 42.7 | 37.5 |
| 38 | K-7 | Electric Boat Co. (San Francisco) | 47.6 | 46.2 |
| 39 | K-8 | Electric Boat Co. (San Francisco) | 47.1 | 45.7 |
| | | **Submarine Tenders.** | | |
| 1 | Niagara | New London Ship & Engine Building Co. (Quincy) | 4.3 | .... |
| | | **Colliers.** | | |
| 9 | Proteus | Newport News Ship Building Co | 74.8 | 67.5 |
| 10 | Nereus | Newport News Ship Building Co | 64.1 | 56.7 |
| 12 | Jason | Maryland Steel Co | 73.4 | 73.3 |
| 3 | Jupiter | Mare Island Navy Yard | 87.9 | 86.6 |
| | | **Gun Boat.** | | |
| 19 | Sacramento | Wm. Cramp & Sons | .... | .... |
| | | **River Gunboats.** | | |
| | Monocacy | Mare Island Navy Yard | 1.2 | 1.2 |
| | Palos | Mare Island Navy Yard | 1.2 | 1.2 |

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